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Incandescent Lighting in Paris.

THE MAGASIN BOISSIER LIGHTED BY AN ISOLATED INCANDESCENT PLANT OPERATED BY A GAS ENGINE.

[Translated for the New York ELECTRICAL REVIEW from *La Lumiere Electrique.*]

Every day witnesses new installations of the electric light in France. Though starting as it does with less favorable conditions than gas, its rival, electricity, nevertheless, is fast gaining upon gas. It has been introduced with gratifying success into the workshops, in the public streets; the gardens have adopted it, and even the great stores, where, up to a very recent date, gas has reigned supreme, have opened their doors to the new illuminant. The general movement toward electrical lighting, slow though it is, is surely spreading, and merits the attention which it is now receiving.

Those who labor under the impression that the general distribution of electricity from common centers is yet but a scheme—that it is something promised for the future, but not yet to be realized—deceive themselves.

At the present time the scheme of furnishing electric light is so far advanced that a consumer is only called upon to pay for the amount of light he uses, just as he is supposed to do in regard to gas; and, if the prices of the two are equal now, the one to the other, it is not difficult to predict that in the near future, should the processes of supply continue to be improved upon at the same rate as at present, electricity will likely enough prove the cheaper illuminant of the two.

Before long all the large establishments will find places in their sub-cellars for electric generators with which to feed the lamps in their various departments; and, notwithstanding the many obstacles to be encountered in a new system, considerable and gratifying results have already been had. The greatest establishments of Paris have set the example, as was fitting they should. The Louvre, the Bon Marché, have for some time been lighted with electricity; and the Printemps, since its reopening, has been illuminated with the Jablochkoff candles, much to the satisfaction of the proprietors.

In the Boissier establishment the incandescent electric lights, recently installed throughout the various departments, had given unusual satisfaction.

The spaces to be lighted are, naturally enough, restricted, and they demand a more or less colored light, in order the better to blend with the amalgamated colors, variegated and constantly changing by reflection and refraction of the various colors of the interior decorations, and the various shades of the merchandise distributed round about.

Before the incandescent lamps were placed in the Magasin Boissier, the large arc lamps were used. But these, useful as they might have been under different conditions, did not prove a success, by reason of the peculiar construction of the various departments. The light was, as might have been expected, too much concentrated, whereas a general distribution of light was what was required.

Now that the incandescent lamps have been set aglow, the illumination is well-nigh perfect, and the general distribution of light which it has been possible to obtain, and the softness of the light, have been the admiration of the crowds who daily gather within the walls of this popular shopping center.

INCANDESCENT LAMPS IN THE MAGASIN BOISSIER.

Fifteen **A** lamps of 140 ohms, and seventy lamps of the **B** type with a resistance of only seventy ohms, have been placed on the ground floor and on the first floor.

The arrangements of the circuits is always the same, and the general plan adopted in the installation tallies very closely with that employed in the Hotel de Ville, which was thoroughly described in a previous number by M. Szarvady.

From that, it is not necessary to conclude that the difficulties of installation diminish with the number of the circuits and the lamps. What can be done in the way of electrica

lighting in such a great edifice as the Hotel de Ville, could not be looked for in one so much smaller, comparatively, as the Magasin Boissier, because in the latter case space is valuable; and, though it is easy enough to suspend any number of lamps from the ceiling of the various rooms and apartments, it is by no means convenient to set apart a certain portion of space for the reception and regulation of the necessary dynamos and apparatus of the plant.

It is this consideration, no doubt, which has more or less opposed itself to a general introduction of electrical plant introduction, and admitting the superiority of electrical lighting to gas lighting; nevertheless, the fact that every one cannot accommodate dynamos and motor in their cellars still makes gas more convenient, because of not necessitating the reception of a plant on the premises, and the generating process.

Nevertheless, many small stores are imitating their extensive rivals. They economize their little space as well as they are able, in order to have electric lighting. But they use gas, too; but not for lighting now, as formerly. It is used to work the engine, which in turn runs the electric generator.

This costs more than if the dynamos were operated by steam; but, then, there is a considerable saving in space and in labor, for the gas comes into the premises automatically, while coal must be brought in by hand.

Sometimes, however, the working of the gas motor is so irregular as to sensibly affect the strokes of the piston; but if a machine with two cylinders be employed, this slovenly movement disappears entirely, and it would be necessary to regard the carbons in the little lamps with fixed attention in order to discover the slightest variations of intensity.

On the Boulevard des Italiens the motor is an "Otto" gas engine, having two cylinders and eight horse-power, making 160 revolutions to the minute, giving to the dynamo, type "Z," a velocity of one thousand revolutions, which results in the development of from 100 to 110 volts. As may be seen in the accompanying drawing [see frontispiece], the lamps have been distributed into little groups. The globes are pear-shaped, and if not as finished as might be, present, nevertheless, a graceful appearance.

The light given out is very considerable, and both more intense and agreeable than the gas formerly used.

The **A** lamps have a power of illumination equal to sixteen candles, and a **B** lamp is in intensity equal to eight candles. This makes, then, a total of 240 candles for the one and 560 for the other—in the neighborhood of 800 candle-power for both.

Imagine to yourself a like intensity with gas jets instead of incandescent lamps, and consider, besides, the price of the amount of heat that would be produced by a sufficient number of gas jets to make up this intensity, and the amount of carbonic acid that would be thrown off, and the superiority of electricity would seem to be sufficiently demonstrated.

The future of electricity, not only as an agent of light, but also as an agent of power, is certainly very encouraging, and it is, moreover, impossible to deny that it is likely to revolutionize the system of lighting which, for so many years, has been in vogue, as well as many of the systems now employed in the various industries. Just now the progress of electricity is slow, but it is no less the sure for all that.

Regarding the little installation in the Magasin Boissier, we have not at hand any official documents from which we can compute the exact price; but we are certain that it is a paying investment in the end for the proprietors, for there are no sulphurous fumes to vitiate the atmosphere, discolor the walls, and worse than all, perhaps, seriously injure the delicate fabrics that are displayed upon the counters, to say nothing of melting and otherwise injuring the bonbons so temptingly displayed.

General Agent M. F. Moore, of the Armington & Sims Engine Company, has just closed contract with the *Globe-Democrat* Company, of St. Louis, for an Armington & Sims high-speed engine; also with Professor B. F. Thomas for an engine for the University of Missouri.

The large ball-room of the Wellington Club, Liverpool, has, up to the present season, been lighted by 550 wax candles on each ball night. Some weeks since the committee invited tenders for the lighting of the room by the electric light, and the offers of Messrs. Holmes and Vaudrey, on behalf of the Liverpool Electric Supply Company, Limited, was ultimately accepted. The light was tried for the first time at the ball on Thursday night, the 31st ult., and was much admired. The Swan lamps (over 100 in number) have been arranged inside elaborate cut glass chandeliers, producing a very striking and beautiful effect. The lamps are driven from a dynamo several hundred yards distant; and, as a matter of precaution against variation or temporary break-down of the light, Faure-Sellon-Volckmar accumulators form part of the installation.

Be Somebody.

Robert J. Burdette, the facetious editor of the Burlington *Hawkeye*, has been lecturing to large audiences in different parts of the country, and in his amusing style he imparts to the rising generation some wholesome advice. The following is from one of his lectures:

"Be somebody on your own account, my son, and don't try to get along on the reputation of your ancestors. Nobody knows and nobody cares who Adam's grandfather was, and there is not a man living who can tell the name of Brigham Young's mother-in-law." The lecturer urged upon his hearers the neces-ity of keeping up with the every day procession, and not pulling back in the harness. Hard work never was known to kill men; it was the fun that men had in the intervals that killed them. The fact was, most people had yet to learn what fun really was. A man might go to Europe and spend a million dollars, and then recall the fact that he had a great deal more fun at a picnic twenty years ago that cost him just 65 cents. The theory that the world owed every man a living was false. The world owed a man nothing. There was a living in the world for every man, however, provided the man was willing to work for it. If he did not work for it, somebody else would earn it, and the lazy man would "get left." There were greater opportunities for workers out West than in the Eastern cities, but men who went out West to grow up with the country must do their own growing. There is no browsing allowed in the vigorous West. An energetic man might go out into the far West, and in two or three years possess himself of a bigger house, a bigger yard, a bigger barn and a bigger mortgage than he could obtain by ten years' work in the East. All young men ought to marry, and no young man should envy old men or rich men. In conclusion, Mr. Burdette said that a man should do well whatever he was given to do, and not despise drudgery.

Theory of Life.

The late Professor Faraday adopted the theory that the natural age of man is 100 years. The duration of life he believed to be measured by the time of growth. In the camel the union takes place at eight, in the horse at five, in the lion at four, in the dog at two, in the rabbit at one. The natural termination is five removes from these several points.

Man being twenty years in growing, lives five times twenty years—that is, 100; the camel is eight years in growing, and lives forty years; and so with other animals. The man who does not die of sickness lives everywhere from 80 to 100 years. The professor divides life into equal halves—growth and decline—and these into infancy, youth, virility, and age. Infancy extends to the twentieth year, youth to the fiftieth, because it is in this period the tissues become firm, virility from fifty to seventy-five, during which the organism remains complete, and at seventy-five old age commences to last a longer or shorter time, as the diminution of reserved forces is hastened or retarded.

The Electric Light in Evansville, Ind.

Our correspondent at Evansville gives us the interesting account of the recent Brush installation there:

"*Fiat lux et erat lux.* Let there be light, and there was light. So it is said in the book of Genesis, and so it was realized in the city last night. The Evansville Brush Electric Light Company on Friday last completed their work, and at midnight gave the friends of the enterprise an exhibition of the power of the lights to illuminate the city. That it was a grand success there cannot be the least doubt, for it even surpassed the expectations of its most sanguine friends. At the appointed hour, in the twinkling of an eye the city was illuminated. There appeared against the background of a dark blue sky the flashes of light from the ten towers and the several arches, like to meteors attended by a series of satellites. Friday night's exhibition was but an experiment, but a successful one. It was the first time the lights were turned on the towers. The location of the towers is admirable, so as to give the most favorable distribution of the light. The city is to be congratulated in securing in advance of other cities the light of the future—we would better say the light of the present, for there can no longer be a question as to the success of electricity as an illuminating power. The electric light was secured by an overwhelming victory of the people over the power of the Gas Ring, and they are to be congratulated upon the completion of the enterprise for which they struggled so hard at the polls.

"No man in Evansville is more deserving of praise in this matter than Mr. Jacob Eichel, who has devoted time and tireless energy to the success of the electric light in Evansville. With wonderful pluck he has withstood the assaults of old fogyism and the rings which for years have fattened upon the city.

"The electric light is a success, and in a few days the illuminated towers will show to the most bitter foes of the enterprise that the city will be sufficiently illuminated for all practical purposes."

On a New Method of Generating Electricity.

[Abstract of paper by J. A. Kendall, F. I. C., F. C. S., read before the Royal Society.]

After referring to the researches of Deville and Troost, and the subsequent experiment of Graham on the penetration of hydrogen through red hot metals, the author describes experiments which he made with a view to constructing a voltaic cell in which occluded hydrogen should take the place of zinc. Cells were constructed by taking tubes of platinum foil, closed at one end, and connected with glass tubes by which hydrogen or other gases could be supplied to the interiors of the platinum tubes. Such a platinum tube could be held in the center of an ordinary platinum crucible, which was intended for the other element of the cell. Various substances were fused in the platinum crucible at a red heat, and by connecting both the platinum tube and the crucible with a galvanometer by means of platinum wires any generation of electricity could be perceived. Several oxidizing salts were tried without success, but by using glacial phosphoric acid at a red heat the author found a distinct production of electricity when hydrogen gas was conveyed into the platinum foil tube. The experiments being continued, it was found that a number of saline bodies in the fused state developed the electrical current with hydrogen, the chlorides of the alkaline and earth metals being quite as efficient as glacial phosphoric acid. It was found that the platinum tube containing hydrogen acted like a zinc plate in a voltaic cell, but it appeared that the hydrogen, after passing through the saline medium, also passed through the walls of the platinum crucible, and it was then oxidised. In order, therefore, to get good results it was necessary to maintain an oxidising atmosphere on the outside of the platinum crucible. A more perfect apparatus was subsequently made for carrying out these experiments, and by the use of this apparatus numerous substances were tested as to their transmitting capacities for hydrogen. Vitreous matters, such as glass, were found to make much better media than the alkaline chlorides. Even porcelain and earthenware were found to transmit hydrogen at a high temperature, under the peculiar conditions of the experiments. The use of glass as a medium made it possible to extend the researches in several directions, as oxidizable metals could be used in association with glass. The method usually adopted by the author was to take a glass tube of suitable quality, and to coat it internally with a metal, either in the form of sheet or as a pulverulent deposit. The glass was carefully fused on to this inner metal, whilst hydrogen was passed through the tube to prevent oxidation of the metal. Then the outside of the glass tube was usually covered with thin platinum foil. On connecting the inner and outer metals with a galvanometer and heating to redness, while hydrogen was supplied to the inside of the tube, the electrical phenomena were obtained with great facility. Nearly all metallic substances appear to be available for the internal coatings of these cells. These effects were easily reversible if a reducing flame was applied externally, and air had access to the interior of the tube, as in this case hydrogen was supplied by the flame.

The quantity of electricity produced by this new method is proportionate to the amount of hydrogen diffusing through the apparatus; or, in other words, to the extent of metallic surface. The production of electricity also increases with the temperature. The electromotive force is, however, low. It was found by the author that the vitreous matters used for the cells were practically non-conductors of electricity of low tension if access of hydrogen was prevented, although they became good conductors when hydrogen was supplied.

The second part of the paper describes experiments in which the hydrogen in flames gives rise to electrical currents by acting on arrangements of glass and metal. A rod or wire of metal, such as platinum or iron, was covered with fused glass, and the glass was overlaid with platinum foil. On connecting the two metals with a galvanometer, and heating the cell in a flame, a current of electricity could be produced, which was due to the withdrawal of occluded hydrogen from the inner wire or rod by the action of an oxydizing flame upon the platinum foil. Also a "reverse" current could afterwards be produced by the action of a reducing flame upon the platinum foil, hydrogen being then re-occluded by the inner metal. An experiment is also described in which a continuous flow of hydrogen was maintained through a cell having a fused vitreous medium by means of a Sprengel vacuum pump. In this case two concentric tubes of platinum were used, and the hydrogen was derived from a reducing flame, by which the apparatus was heated. The inner tube was connected to the Sprengel pump. By this apparatus a continuous current of electricity was produced. The author also describes some experiments which illustrate the remarkable atomic force which hydrogen in flames exerts by reason of its great penetrative powers.

A Cable Steamer's Mishap.

LONDON, Feb. 21.—The steamer Faraday, which left Queenstown some time ago with a portion of the new Mackey cable on board, has returned to Portland. She has lost her port propeller, and is coming to London for survey.

The Faraday is owned by the Siemens Company, of London, who have contracted to lay the new cable. It does not become the property of the Bennett-Mackey Commercial Company until it is completed, and has been in good working order for thirty days. The Faraday has been out about sixteen days, but made frequent stops to take soundings. Geo. G. Ward, the superintendent of the Commercial Company's affairs in this country, said last night that the mishap would cause no delay in completing the work by next fall.

Economical Electric Light Plants.

A few years ago the proper equipment of electric light plants was as little known as the future of the invention which is now and will continue to be *the* illuminant of all others. But little attention had been given to the economical construction of central station plants by the companies then in the field. In most cases care was taken to select engines that were of a high standard, but aside from this the economic application of power to the dynamo and low running expenses was not, until a very recent date, given that attention it so much needed in the beginning. As soon, however, as the parent and subsidiary companies had been in the field of actual lighting they found in some instances that instead of having the best motive power and the cheapest system of converting fuel into electrical energy at the quickening power of their dynamo that they had the most extravagant. This is but an illustration of what must always occur in the progress of any business before it has reached the point where it becomes comparatively successful in dealing with the small details of that business.

About one year ago we took up the subject of steam power for electric lighting, and since that time much has been done by the electrical press in bringing into notice many valuable inventions and apparatus for the more economical building and running of central station and isolated plants. The companies are giving closer attention to this important subject now than formerly, with excellent results. Our mails show a greater interest in this matter than we have seen manifest before. This is not without its effect, for we notice many improvements in the system of constructing plants in every one that is now being built throughout this country. Engineers, builders of steam-engines, manufacturers of boilers for the economical production of steam and its conversion into power are all at work upon this absorbing question. Is it then too much to hope that all this work will be fruitless, or that we shall not come out of the entanglements of the past into something like a substantial and permanent basis in the near future?

We give herewith an illustration of a complete system from the grate bars up to the dynamo connections with the engines. This method has been favorably commented upon in these columns several times during the past year, and is, so far as we have been able to learn, one of the simplest and most econominal yet devised and put into practical use.

The *Manufacturers' Gazette* of February 16th gives some interesting facts upon the success of this system, as follows:

"It represents a plan of an electric light plant, as constructed and fitted up by the Jarvis Engineering Company, Boston, Mass. The first electric light station ever built in this country, in New York city, was fitted up by this company, with boilers set with the Jarvis Patent Furnace. This was followed by stations in Albany, Boston and Baltimore. Believing that electric lights had come to stay, they determined to make this business a specialty, and from actual experiments soon found that to make these stations pay a profit many changes were required. Not only must the cheapest and lowest cost fuel be used, but the loss of power caused by using long lines of shafting must be overcome.

After carefully looking over the field, they decided that the Armington & Sims engine was the one required for that purpose, and they gave the first order for a 9½x12" engine of this make that was ever given to run dynamos direct with engine by belts, without the use of shafting. This engine run one No. 7 and one No. 8 Brush dynamos, furnishing 56 arc lights in one circuit. They have the full agency for this engine in New England, and have now many plants in the Middle and Southern States.

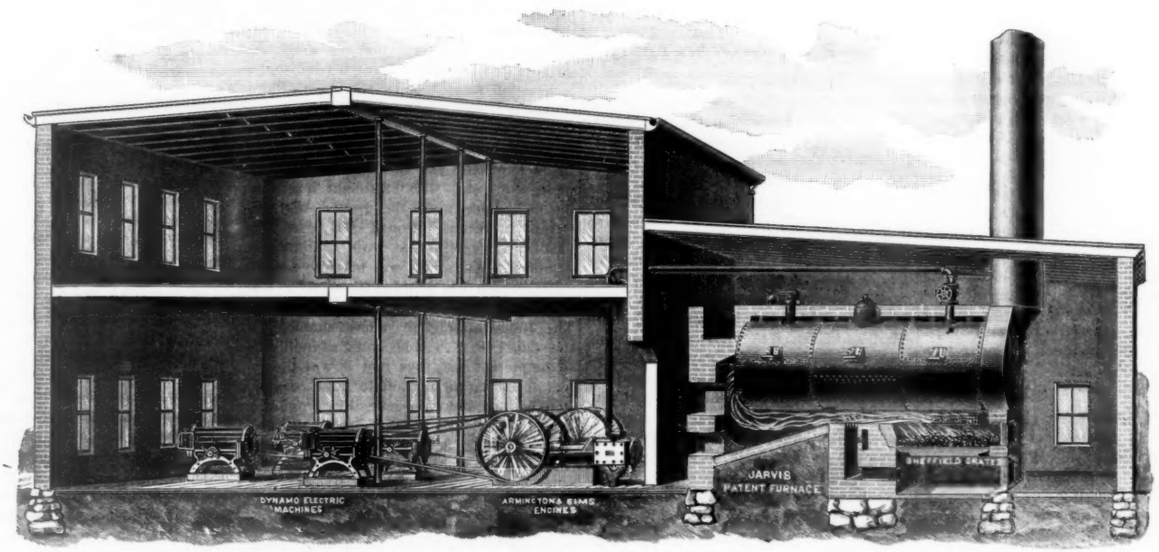
The cost of fitting up a station on this system is from twenty to fifty per cent. less than the old way, with long stroke engines and long lines of shafting, and the saving in power is from fifteen to twenty-five per cent. on the cost of running.

Selling electric lights is virtually selling power, and the cheap production of the steam power is the important feature of running an electric light business. The Jarvis Engineering Company have made special efforts to reduce this cost to a minimum. The boilers of their plants are set with the Jarvis furnace, and the fuel used is usually a mixture of screenings and soft coal, costing about one-half that of good coal.

In close proximity to one of their stations, which pays less than $3 per ton for its fuel, is one of a rival company using good coal at a cost of $6 per ton; on a basis of 7 hours run, using four pounds of coal per horse-power (the stations being about 100 horse-power each), the coal used would be, say, 2,800 pounds, and, 300 nights run per year, would amount to consumption of 840,000 pounds; thus the difference in the cost of fuel per year would be nearly $1,300. This item of fuel alone is well worth the consideration of manufacturers as well as electric light people, for, with the latter companies, those using long-stroke engines and high-cost fuel must either change their mode of running, or eventually succumb to the competetion of the companies properly equipped, who can show a profit while their competitors are running at a loss.

The Jarvis Engineering Company can justly take pride in the success of the companies equipped by them, most of them being on a dividend-paying basis.

They have fitted up the following plants on this system: Brush Electric Light Company, Boston, Mass.; American Electric and Illuminating Co., Boston; Merchants' Electric Light Co., Boston; Narragansett Electric Light Co., Providence, R. I.; Woonsocket Electric Light Co., Woonsocket, R. I., Middlesex Electric Light Co., Lowell, Mass.; Hartford Electric Light Co., Hartford, Ct.; New Haven Electric Light Co., New Haven, Ct.; Consolidated Electric Light Co., Portland, Me.; Lewiston Electric Light Co., Lewiston, Me; New Bedford Electric Light Co., New Bedford, Mass.; Fall River Electric Light Co., Fall River, Mass.; Syracuse Electric Light Co., Syracuse, N. Y; Bridgeport Electric Light Co., Bridgeport, Ct.; Brush-Swan Electric Light Co., Norfolk, Virginia.



ELECTRIC LIGHT PLANT AS CONSTRUCTED AND FITTED UP BY THE JARVIS ENGINEERING COMPANY, BOSTON, MASS.

The Scrivanow Battery.

According to the *Electrician*, this battery, as used to supply current to the head-lights of the ballet girls in "La Farandole," at the Paris Opera, is composed of the following elements: A plate of zinc and chloride of silver, wrapped in parchment paper, constitute the electrodes, and these are plunged in an alkaline electrolyte. The whole is inclosed in gutta percha cells. The size of the battery is five centimeters high, six centimeters wide and fifteen millimeters thick. The manner in which these batteries are fitted on the dancer is very ingenious. The cells used are arranged in the buckles of a girdle round the girl's waist, the real fastening being at the back. The wires are led round to the back, and then pass up under the hair to the ring which fits on the top of the head, and carries the lamp and glass star.

The New Professor of Mechanical Engineering at Sheffield Scientific School.

It is announced that Mr. C. B. Richards, superintendent of the Southwark Foundry and Machine Company, Philadelphia, and former mechanical engineer at Colt's Armory, Hartford, is to fill the vacancy caused by Professor Dubois' transfer from the chair of Dynamical to that of Civil Engineering at Sheffield Scientific School, Yale College.

In securing the services of one of Mr. Richards' large and rare experience as a practical engineer, Sheffield is to be highly congratulated. It is to be hoped that the practical ingenuity and skill in devising experimental apparatus, which has marked Mr. Richards' commercial career, as exemplified in the Richards' steam engine indicator, the automatic testing machine, and various dynamometric apparatus, at Colt's armory, and the several ingenious appliances used in the ventilation of the Hartford State House, may now have their application in scientific investigation, while it cannot be doubted that Mr. Richards' great knowledge of applied mechanics will render his services as an instructor of the choicest value to the student.

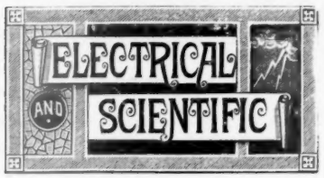
Vice-President Joseph P. Davis, of the Metropolitan Telegraph and Telephone Company, while holding the office of City Engineer of Boston, began the work on the sewerage system of this city, which has just been completed at an expeuse of $5,554,272.89. It is said to equal any similar work in the world.

On the occasion of the opening of the Turin Electrical Exhibition, the Italian Government will present a prize of 10,000 francs to the inventor of the most practical process for the generation and transmission of electric power in the form of motive force and light. All nations may participate in the competition.

At the present day electricity has become a necessity of every-day existence, but had not Madame Galvani been attacked by that severe cold in 1790, the electric telegraph might yet be a thing of the future. The good lady, instead of putting her feet in mustard and water, and dosing herself with thin gruel and spirits of nitre, was ordered to take a bowl of frog soup. Those who have tasted that delicious preparation may know that the hind legs only of the frog are used for making the soup, and the mere chance of hanging the legs by copper hooks from an iron rail caused the crural nerves to contract as if endowed with life, and the electric current was discovered. Galvani, it must be said, merely considered the reptile as an animated Leyden jar, and it was left to Volta, in 1800, to attach the right importance to the action of the frog's legs. We are not told whether Madame Galvani's cold got better, but we sincerely hope in common gratitude that it did.

Two Kinds of Magnetism.

How much magnetism New York has of a certain kind it is not stated, but of another kind the Philadelphia *Ledger* remarks that tests made of the elevated-railroad structures, of the Brooklyn bridge cables, iron store fronts, &c., show that they are all magnetized. The induced magnetism from the earth is supposed to have been fixed by the jarring to which these structures have been subjected while under magnetic influence. The bottom parts of all pieces of iron thus magnetized show north polarity, and the cables of the bridge are said to be magnetized in the direction of their diameter, the upper surface of the cables, throughout their length, being of south polarity and lower surface north. A few of the posts of the elevated railroad did not possess magnetism, so far as the tests showed, but the great majority did, and the trusses were so magnetized as to have their upper chords of south and their lower chords of north polarity.



The Brush-Swan Electric Light Company began Tuesday to illuminate the city of Norfolk, Va. No other city in that State is lighted by electricity.

A movement is on foot for lighting the city of Haverhill from towers with electric lights. A tower one hundred feet high on Hotel Webster having six lights, will be used to test the practicability of the project.

The meeting of the New York Electrical Society, which was to have been held Wednesday, February 20, was omitted.

The annual election of officers will take place at the next regular meeting, Wednesday, March 5.

A certificate of incorporation of the American Electric Transportation Company was filed on the 15th inst. in New York in court. The object of the company is to construct and furnish materials to be used on street railroads, and for manufacturing machinery to be used for the purpose of propelling cars by electricity. The capital stock is stated to be $1,000,000.

Two companies, with headquarters in New York City, and with objects to manufacture electrical apparatus, were incorporated Feb. 21. The Edison Machine Works has a capital of $200,000, and Thomas A. Edison, John Kruesi and John R. Campbell as trustees; and Bergman & Co. has a capital of $300,000, and Thomas A. Edison, Edward H. Johnson and Sigmund Bergman for trustees.

Among recently contrived electrical novelties is a form of galvanic battery, or rather dry pile, invented by Mr. C. Schneler, of Dresden. It consists of two cylinders of such a size that when placed one within the other there is a clear annular space between them. The outer cylinder is of copper, and the inner one of amalgamated zinc. The space between is filled with plaster of Paris, previously made into a cream by adding a saturated solution of chloride of zinc and a small quantity of common salt.

Last month the chief streets of St. Petersburg were for the first time illumined by electricity, the brilliant light, according to Russian papers, turning night into day. Its success seemed perfect, but unfortunately it was only on that night that the inhabitants were allowed to enjoy the full advantage of the light. The next night it was only after several hours of darkness on one side of the Nevski Prospect that all the lamps were lighted, and since then it has been found that some time must elapse before the new installation will be perfected, so as to afford continuous illumination every night.

The directors of the American Electric and Illuminating Company met Feb. 20th and declared the regular semi-annual dividend of 4 per cent., and also an extra dividend of 2 per cent., upon the company's preferred stock. They also declared the semi-annual dividend of 2 per cent. on the common stock. The extra dividend upon the preferred stock begins to look like a customary event, thereby making it a 12 per cent. stock, and the common a 4 per cent. stock, which upon its present price is paying 8 per cent., the par value being $10. To-day sales of the latter were at 4⅞@4⅛, and at 5 buyer 10 days, closing at 4⅞ bid, and 5 asked. The dividends are payable March 1 to stockholders of record February 25.

An exchange says that an electrodynamic company of Philadelphia has a machine for the application of electric power to sewing machines, lathes, surgical and dental tools, etc. This is a little dynamo machine, weighing only forty ounces, which is called the double-induction motor. It derives its power from a battery of carbon and zinc element, and is claimed to be the only practical electric motor for the dwelling, laboratory, etc. It is so constructed as to be easily attached to the sewing machine or lathe table, and the cells of the batteries are so arranged that the zinc carbon plates, when the machine is not running, are left out of the cells, and there can therefore be no waste of material when power is not required. There is one great idea about it, and that is that the power can be regulated at the will of the operator. This is brought about by the degree of immersion given the plates. The speed of this motor, varying at the will of the operator from any number to a number of thousands of revolutions a minute, renders it a valuable aid to surgeons for driving the various instruments designed to remove necrosed bone, for rotary lancet, etc. Its operation of an ordinary sewing machine for family work will be only from 25 cents. to 40 cents per day, according to the work done or the power required to operate.

Chaperon and Lalande's New Battery.

In this form of single fluid battery, oxyde of copper and metallic zinc are subjected to the action of a solution of caustic potash. Its construction is thus described in the *Polytechnisches Notizblatt:*

The oxyde of copper is put in an open box of sheet iron which sits on the bottom of the glass jar, and to it is riveted a copper wire insulated with India rubber. This constitutes the positive pole of the battery. The negative pole consists of a half inch cylindrical bar of amalgamated zinc coiled into a spiral, and fastened to the lid so as to remain suspended some distance above the box of oxyde of copper. The upper portion of the zinc, where it rises to the lid, is covered with India rubber tubing, so that it may not be in contact with the liquid. The exciting fluid consists of a solution of 30 or 40 parts of caustic potash in 100 parts of water. Potash is preferred to soda, although the latter is cheaper, owing to the tendency of soda to effloresce. To prevent absorption of carbonic acid from the air, the jar must be provided with a close-fitting lid or cover.

Among the advantages claimed are these, that the contact of the iron with the oxyde of copper depolarizes the positive electrode. The reduced copper can be easily oxydized again by exposing it to damp air. If a current from a dynamo be passed through this battery in the opposite direction, the reduced copper will absorb oxygen, the dissolved zinc will be again reduced, and then regenerated. The new element is said to be very constant. One of these was used to ring a bell at the Vienna exhibition from beginning to end, with no other attention than the replacing of the evaporated water from time to time. A picture of the battery may be seen in the journal above referred to, in which the peculiar arrangement of the zinc pole is shown, but other forms will probably be found to answer as well.

The New Bedford Electric Lighting Company has offered to put electric lights in the large room of the Public Library for a month on trial free. This company is composed of five gentlemen, and is the best paying electric light company in the country. Everything is reduced to the lowest cost. They do not pay any salaried officers. The treasurer is one of the five owners. The engineer is superintendent, and one fireman is employed with two line men. They use two Armington & Sims engines, and their boiler is set with the Jarvis Patent Furnace; they burn pea coal for fuel. Electric lighting will always pay if conducted on a business basis.

In Liverpool the "Acme" system of electric lighting is being tried. It consists of a primary battery, costing £50, which will give twenty lights, of twenty candle-power, during forty-six hours. It is added that the cost of maintenance is, "perhaps, a little more than the price of gas."

Telegraph-Telephone Companies' Rights.

IMPORTANT COURT DECISIONS—THE PRIVILEGE OF ERECTING POLES ON THE HIGHWAY.

A decision has recently been given by the Supreme Court in the suit in equity brought by Jacob W. Pierce and others against Chas H. Drew and others, upon the question of the rights of telegraph companies to erect poles in the public highway. The bill was brought to enjoin the defendants, as selectmen of Brookline, from granting to the American Rapid Telegraph Company a written permit, under Public Statutes, Chapter 109, to construct a line of telegraph in certain highways in Brookline, on the ground that the act was unconstitutional. There was a demurrer to the bill. The facts admitted by the demurrer were that the plaintiffs own land on a certain street or public highway in Brookline. They also own a fee in the one-half of the street which is next to their abutting land. The defendants are the selectmen of Brookline, and are about, on the application of the telegraph company, a corporation formed under the general laws (Public Statutes, Chapter 106, Section 4) for the transmission of intelligence by electricity, to grant to that company, under P. S., c. 109, a location along the highway for their posts, wires, etc. The bill sought to restrain the defendants upon the ground that the statute is unconstitutional. The case was heard by a single justice, who sustained the demurrer. An appeal was taken to the full court, which has affirmed the decree. The opinion of the court is by Judge Devens. The Judge, after giving a brief summary of the statute (P. S., c. 109), so far as applicable to the present case, says that it was the intent of the statute to grant to those corporations formed under the general incorporation laws (P. S., c. 106), for the purpose of transmitting intelligence by electricity the right to construct lines of telegraph upon and along highways and public roads upon location assigned them by the officers of the municipality, wherein such ways are situated, cannot be doubted. If the use of property already appropriated to certain public uses is to be deemed itself an exercise of the right of eminent domain, the determination of the Legislature that the purpose for which it now directs it to be taken is a public use, is not necessarily conclusive; but if the use is public, it is conclusive that the necessity exists which requires it to be taken. The transmission of intelligence by electricity is a business of public character, to be exercised under public control in the same manner as transportation of goods or passengers by railroads. No right is given to these telegraph corporations to use the highways at their own pleasure, or to compel, in all cases, locations therein to be given them by the municipal authorities.

Questions were presented for consideration, first, whether the statute provides any compensation to the owner of the fee for the new use of the highway; second, whether he is entitled to such compensation; and third, whether the owner of property near to or abutting is entitled to any compensation therefor other than such as the act provides. The statute does not, in the opinion of the court, provide for damages to the owner of the fee in the highway, by reason of the erection of the telegraphic posts and apparatus; and the question was to be determined whether such a use of it operates as a separate and additional burden requiring an independent assessment of damages, for which the owner of the land was not compensated when the highway was laid out, and whether the omission of the act to provide this compensation renders it unconstitutional. For more than thirty years the right to appropriate the highways to this public use, without any compensation to the owners of the fee therefor, has been asserted. After so long a practical construction by the Legislature and the court, and after so widely extended an acquirement by parties whose estates have been affected, it would require a clear case to justify the court in setting aside such a statute as unconstitutional. No right to take the private property of the owner of the fee in the highway is conferred by the act. All that is given is the right to use land by the permission of the municipal authorities, the whole beneficial use of which had been previously taken from the owner and appropriated to the public. It is a temporary privilege only which is conferred. No right is acquired as against the owner of the fee by its enjoyment, nor is any legal right acquired to the continued enjoyment of the privilege, or any presumption of a grant raised thereby. The discontinuance of a highway would annul any permit granted under the statute, and no incumbrance would remain upon the land. Where land has been taken or granted for highways, it is so for the passing and repassing of travelers thereon, whether on foot or horseback or with carriages; for the conveyance and transportation of passengers and property, and for the transmission of intelligence between the points connected thereby.

It has never been doubted that by authority of the Legislature the highways might be used for gas and water-pipes intended for the convenience of the citizens, although the gas or water was conducted thereunder by companies formed for the purpose or for sewers, whose object was not merely the incidental one of cleansing the streets, but also the drainage of private estates, whose rights to enter therein were subject to public regulation. When the land was taken for a highway, that which was taken was not merely the privilege of traveling over it in the then known vehicles, or of using it in the then known methods for either the conveyance of property or transmission of intelligence. Although the horse railway was deemed a new invention, it was held that a portion of the road might be set aside for it, and the rights of other travelers to some extent limited by these privileges necessary for its use. The discovery of the telegraph developed a new and valuable mode of communicating intelligence. Its use is certainly similar to, if not identical with, that public use of transmitting information for which the highway was originally taken, even if the means adopted are quite different from the post-boy or the mail-coach. It is a newly-discovered method of exercising the old public easement, and all appropriate methods must have been deemed to have been paid for when the way was laid out The court was, therefore, of opinion that the use of a portion of the highway for the poles, etc., of companies formed under the laws of the State, in transmission of intelligence by electricity, and subject to the supervision of the local authorities, which has been permitted by the Legislature, is a public use similar to that for which the highway was originally taken, or to which it was originally devoted, and that the owner of the fee is entitled to no further compensation. Section 4 of the statute gives such remedy as the Legislature deems sufficient for the owners of the property near to or adjoining the way, who may be immediately injured by the structures which the telegraph companies may have been permitted to erect along the line of the highway. The majority of the court were satisfied that the demurrer to the bill was properly sustained, and the entry was that the decree be affirmed. A dissenting opinion was given by Judge Chas. Allen, which was concurred in by Judge William Allen.

Place for the New Cable to Land.

The new Bennett-Mackay Cable Company will land one end of its cable on Cape Ann, Mass., and has bought land for this purpose at Cape Hedge, Long Beach. A cable station is to be erected at Rockport, the dimensions of which will be 60x45 feet, and two stories high. The cable will be laid about two feet underground for a distance of one-and-a-quarter miles to the station in the town.

TELEGRAPHIC

The colored coachman of Supt. R. C. Clowry, of the Western Union, shot another coachman in Chicago recently.

A despatch from Atlanta, Georgia, says the Supreme Court has decided that the Western Union Telegraph Company is responsible for the gross negligence of its agents in transmitting messages, and it is immaterial what is printed at the heads of blanks.

DIVIDEND.—At the regular quarterly meeting of the Board of Directors of the Mutual District Messenger Company, of Boston, held at 47 Devonshire Street, February 12th, a quarterly dividend of two dollars per share was declared payable March 1st. The net earnings for the quarter were $5,399.91 over 11 per cent. on the capital.

HARRISBURG.—A charter was granted on the 14th inst. to the Postal Telegraph and Cable Company of Philadelphia; capital $20,000. The line is to run from Limestone, N. Y., to a point in Hanover Township, Washington County, Pa. The shareholders are Charles T. Creswell, Albert B. Guilbert, Severo Mallet Prevost, Henry Cummins and Theodore B. Armstrong.

OTTAWA, ONT.—The Bennett-Mackey Cable Company's bill was passed Feb. 20, by a special committee to which it was referred. Objection was taken to the extensive powers asked by the company to build new lines and amalgamate with existing lines. Amendments were made confining the company simply to the laying of cables and the constructing of land lines sufficient to enable them to make the necessary connections with the existing system.

ALBANY.—The International and Eastern Telegraph Company, with a capital of $5,000,000, which may be increased to $10,000,000, was incorporated here on the 19th inst. It proposes to construct lines from New York City northward, eastward, southward and westward, connecting the cities of New York, Albany, Buffalo, Cleveland, Chicago, Ogdensburgh, Montreal, Toronto, Halifax, Boston, Portland, New Orleans, San Francisco and intermediate points. The trustees are Dewitt C. Wykes, J. G. Johnston and Arthur H. Walker, of New York.

Henry Day, executor of the estate of the late ex-Governor Edwin D. Morgan, made an argument before the Senate Committee on Post-Offices and Post Roads, at Washington, D. C., on February 14, in behalf of the Morgan estate. Twenty thousand shares of the Western Union stock formed a part of the estate. Mr. Day opposed the postal telegraph projects on the ground of injury and injustice to people who had invested in the stock of the existing companies. "If," he said, "this measure is a necessity, then it should be carried out in a manner so as to do no injustice to present owners of telegraph stock. The telegraph property in the country should be taken under the right of eminent domain, and paid for at the fair market commercial value of the same. It would be grossly unjust to take advantage of all the improvements which the telegraph companies have developed at great cost in years past in building cheap lines between great centers, and leave the feeble and unprofitable lines to the present companies, and to bear the risk and burden of all enterprises and improvements heretofore undertaken."

General Manager Hern, of the Mutual District Messenger Co., says that the company does not owe a dollar, and that its expenses include payments for taxes and maintenance of lines. During the past quarter the company delivered and collected in the city 404,723 messages, on which the tolls averaged 40 cents each. The company has an exclusive contract with the Western Union Telegraph Company for eleven years. The report of the treasurer, Mr. Allen S. Weeks, shows receipts for the quarter of $24,592.89, and expenses of $19,192.98, making net earnings for the quarter $5,399.91. The total stock of the company is $250,000, of which $50,000 is in its treasury.

Honoring Telegraph Operators.

WASHINGTON.—The bill to accord a military status to the telegraph operators who served on the Union side in the war of the Rebellion, by issuing commissions and preparing muster-rolls, was reported favorably to the Committee on Military Affairs by a sub-committee, but has been referred back for an amended report. Objection was raised in the full committee to conferring rank as tending to confusion, and to the preparation of new rolls as being too laborious. There was, however, every disposition to recognize the services of the telegraphers. It was agreed that certificates reciting the services of each should be issued instead of commissions, and providing for the distribution of medals. The operators have asked for a hearing, which will be given on February 22.

TRENTON, NEW JERSEY.—The Philadelphia and Seaboard Telegraph Company has just been incorporated under the laws of this State. George B. Pennock is President and General Manager; Milton Cowperthwait, Secretary and Treasurer; Charles M. Burns, of Philadelphia; J. Edward Conover, of Jamesburg; Milton Cowperthwait, and George B. Pennock, of Riverton, are the directors. The company announces that it will establish lines throughout the United States with a newly-invented underground and subaqueous cable, and will also manufacture cables for the trade. On February 25, it is said, the work of laying the cable from Philadelphia to Mount Holly will begin. It is the intention to cover all the seashore section of New Jersey before June. New York will be reached by Trenton, and also by Long Branch. The cable contains copper conductors, and is so heavily insulated that a bunch of wires is said to have been working perfectly under water for weeks without any covering. The rate for messages between the two great cities named and the seaside will be 10 cents for ten words, while there will be a comparative reduction in night messages. The line between Philadelphia and Camden will be completed by March 1, while New York will be reached by May.

A telegram from Springfield, Ill., states that among the licenses issued to open books of subscription to the capital stock of various companies, by the Secretary of State, was one to "The Chicago, St. Louis and Southwestern Telegraph Company," at Chicago, whose capital stock is placed at $5,000,000, and which is authorized to operate overground and underground telegraph and telephone lines; the incorporators being George W. Cass, William P. Elliott, and J. O. Osborne, all of this city. A recent interview with Mr. Cass, as to the objects and intentions, disclosed the following: Said Mr. Cass: "The intention is to build a line to St. Louis, and the line will probably come to Chicago and connect with some eastern line at some point in this State; possibly here, or may be south of here. I presume that the intention is to extend the line to Kansas City, or to some point south of that; but just what eastern connections we shall have I am hardly able to say now; but I can say this much, that we shall connect with some one or more eastern lines, as the men connected with our company are telegraph men and builders, and they must have such connections in view. The object, in short, is, probably, to connect St. Louis and the Southwest with some of the eastern lines which have been projected here."

"When will the work be commenced?"

"It is understood that the work will be commenced during the next thirty or sixty days. It will take some little time before the organization is completed, but telegraph lines are built pretty fast nowadays after everything else is arranged. The next meeting of the incorporators will be at my office in about two weeks, probably."

"Where will the work probably be commenced?"

"From St. Louis, and will be extended east and north from that point; but the headquarters will be located in this city."

Canadian Telegraph Lines.

INTERESTING STATISTICS.

The length of telegraph-pole miles in the world, and the number of offices are given thus:

	Miles.	No Offices.
Europe	280,261	35,041
North America	177,838	16,160
Asia	32,937	624
Africa	14,097	284
South America	25,264	866
Central America	2,209	100
Australia	27,831	675
Various Islands	5,397	257
Total	565,834	54,007

The approximate number of messages sent: In Europe, 108,000,000; North America, 50,000,000; South America, 1,000,000; Central America, 500,000; Asia, 3,600,000; Africa, 2,000,000; Australia, 6,000,000; various Islands, East and West Indies, etc., 2,000,000. It is to be remarked that the miles of line given in the above table do not represent the total length of wire, for there may be several wires on the one set of poles. Thus in Europe there are estimated to be 806,000 miles of wire, while only 280,000 miles of poles are given; and in North America there are between 500,000 and 600,000 miles of wire to 177,000 miles of poles.

The claim made in the *Blue Book* that "Canada possesses greater telegraphic facilities than either the United States or any European country," is shown by the figures to be well-founded. And going before the country in the shape of a government return, is likely to command the attention it deserves. The number of offices in Canada is 2,259, or one to every 1,014 persons, while in Switzerland the proportion is one to every 2,500; in the United States, one to every 3,700; in France, one to every 6,231, and in Great Britain, one to every 6,508.

With reference to the number of messages sent from each office, the average in Canada is 1,441; in Germany, 1,571; in Switzerland, 2,748; in France, 3,300; in the United States, 4,062, and in Great Britain 5,758. "This greater average of messages," proceeds the report, "is, in the older countries, due to the greater density of population, while in the United States it is, to a large extent, due to the enormous amount of speculation on the Stock and Produce Exchanges of New York, Chicago, and other large cities—millions of messages annually consisting merely of repetitions of quotations of stocks, grain, etc.

Mr. H. P. Dwight, the general manager of the Great North Western Telegraph Company, having been consulted by the Secretary of the Department with reference to the extent of telegraphic facilities and business in the Dominion, writes that in mileage of lines and number of offices in proportion Canada exceeds England by nearly four to one.

"It seems to be inferred," writes Mr. Dwight, "that we in Canada are in some way behind-hand in telegraph enterprise, although I have yet to see any comparison made to prove that this is the case."

Canadian tariffs are probably the cheapest in the world, taking all things fairly into account, and will still compare favorably with the reduced rate of sixpence shortly to take effect in England. "Telegraph wire and other material we require are brought from England," proceeds Mr. Dwight, "duty and charges make these articles cost us from 25 to 50 per cent higher than in England. Wages of linemen, operators and other employes are from 50 to 100 per cent. higher in Canada than in England, and messages are sent on an average three or four times as great a distance. Our repairs and maintenance are more expensive, owing to the fact that many of our lines are built in lone stretches, along bad roads, and in sparsely settled districts, where the wires are frequently broken by fallen timber and other causes. The Great North Western Telegraph Company sends messages 1,200 miles for twenty-five cents, about equal to an English shilling, and between all towns within twelve miles distant, at 15 cents. The new English rate sixpence was passed by Parliament, but strongly opposed by the Government. After many years the English Government has finally got the system to be self-supporting at a shilling rate. To reduce the rate to sixpence, it will require twice as much business to bring the same return. This increased business requires greatly increased facilities and increased expenses of every kind. The least possible *loss* estimated by the British Postmaster General in conducting the business under the reduced rate, even after adding these facilities and reducing the number of words in messages, which he intends to do, is $850,000 per year."

In Canada the length of telegraph wires is 45,728 miles, and number of offices 2,259. This, with a population of three millions and a half, gives a telegraph office to every eighteen hundred persons, while in the United States there is but one to every thirty-seven hundred. Nor does any European country approach ours in the number of telegraph offices in proportion to the number of inhabitants. Hence, we repeat, it is a matter of congratulation that in the words of the Government report, Canada possesses greater (and cheaper) telegraph facilities than the United States or any other European country.

The Great Deluge.

TERRIBLE CONDITION OF AFFAIRS IN THE OHIO VALLEY.

The flood has caused great suffering and has done immense damage in Cincinnati and neighboring cities and villages; but the people are not cast down. They bravely endure what can not be cured, exhibiting the genuine American virtue of good nature in adversity.

It is noticeable that Western cities, not immediately in danger from inundations, have been among the foremost in the good work of collecting and sending money and supplies for the relief of those who have lost everything by the floods. The ready-handed people have a more lively sense of the terrors and the perils of a great freshet than those who have had no actual experience to teach them.

But in remote points of the country an active interest is shown in the misfortunes of the half-drowned inhabitants of the Ohio Valley. From points in New England, and as far south on the Atlantic seaboard as Baltimore and westward to St. Louis, we hear of active movements for the relief of the sufferers. The Governor of Ohio has appointed a State Relief Commission, under whose supervision money, supplies of cooked food, clothing, blankets, medicines, and other articles of necessity will be distributed. We regret to learn that the City and Suburban Telephone Company's losses will greatly exceed those caused by last year's flood.

Mr. Wm. B. Gill was, on Friday last, appointed superintendent of the Western Union Telegraph Company, to fill the vacancy caused by the resignation of Mr. J. E. Zeublin. Mr. Gill was at one time assistant superintendent of this district. At present he is superintendent of the Delaware and Atlantic Telegraph and Telephone Company.

Telephonic News

The Portsmouth, Ohio, telephone exchange was entirely destroyed by the recent great flood there.

Two partners in the same crime, confined in separate cells in a Texas prison, constructed a paper telephone and carried on conversation by means of it, notwithstanding the fact that the greatest pains had been taken to prevent them from getting together and making up a story between them.

There is no doubt that the Bell Company is now doing a very profitable business, and one which would justify higher dividends, if all litigation were ended. It is expected that the company will have a cash surplus of $750,000 after payment of the April dividend. An extra dividend might be paid, but, judging from the past, the company is likely to pursue a very conservative course.

The annual meeting of the Empire State Telephone and Telegraph Company was held on the 18th inst., and the following officers were chosen for the ensuing year: H. L. Storke, President; Dexter A. Smith, Vice-President; James Seymour, jr., Treasurer; George Underwood, Secretary; H. L. Storke, General Manager; Fred. C. Timpson, Assistant General Manager.

The Iowa Union Telephone Company has not consolidated with the Iowa and Minnesota Telephone Company, as previously announced. The Iowa Union Company is doing a very excellent business, and its stock cannot be purchased, we understand, for less than par. Their business has increased very largely during last year under its present excellent management.

Mr. Charles A. Rolfe, formerly of Utica, New York, will now represent the Electrical Supply Company of New York. The telephone and telegraph people need no introduction to Mr. Rolfe, as he has been long and favorably known in that field. The Electrical Supply Company have secured in him a worthy representative, who is experienced in the business.

The following cablegram has been received by Tropical American Telegraph Company from Rio de Janeiro: "Supreme Court reverses decision District Judge, and confirms Bell patents for Brazil." This decision gives them the same control in Brazil which the American Bell Company has in the United States. Telephones sent to Brazil since July last or hereafter, excepting those operated by Tropical Company, will be confiscated, and the consignee sued for infringement of Brazilian patent, and shipper sued for infringement of United States patent.

The business of the Union Telegraph and Telephone Company, which includes Washington, Warren, and Saratoga counties, N.Y., is steadily and rapidly growing. Even in Saratoga, which is at this season one of the deadest and dullest places imaginable, the number of new subscribers connected with the telephone exchange since October 1, 1883, is greater than the number of telephones disconnected at the end of "the season." This result is largely due to the energy and excellent management of Superintendent Harry T. Downs, brother of General Manager Loren N. Downs, of the Lowell syndicate, who is proving himself emphatically the right man in the right place. Mr. Downs is also making arrangements to establish an electric-lighting company in Saratoga.

The American Bell Telephone Company have given notice of the determination of the contract of February 12, 1881, on the 16th day of May next, under which the Mexican Telephone Company, by assignment from the Continental and Tropical American Telephone companies, secured the sole right to export telephones and telephonic apparatus from the United States into the republic of Mexico.

The question of a future contract for Mexico has not been determined or settled; but, as the Mexican Telephone Company is bound by contracts with its sub companies to furnish them with American Bell Company's telephones, the question is quite a serious one for that company.

The Tropical Company have notified the Mexican Company of this action by the American Bell Telephone Company.

The agent of the Tropical American Telephone Company at Buenos Ayres writes under date of Jan. 3 that the December receipts of the United Telephone Company were $10,658.70, and the expenses $8,893.77. The present subscription list numbers a little over 1,200. Sales promise to be larger this month than on any previous one. They amount to $5,382; gained 52 subscribers in December. Advices from Rio de Janeiro state that the Companhia de Telegraphos Urbanos has the following exchanges working:

Rio de Janeiro, with 822 subscribers; Nicthroy, opp., with 43 subscribers; Petropolis (corrected by cable), 27 subscribers; San Paulo, with 110 subscribers; companies just opened, 3 subscribers; total, 1,005 subscribers.

The company is in treaty for the establishment of exchanges in four other large cities, under a guarantee of 600 subscribers at the start. The latter half of 1883 was a period of unusual activity in telephone affairs in Brazil, but 1884 has opened with still better prospects. Both of the above companies are sub-companies of the Tropical, in which the Tropical has a stock interest, besides sending them about 150 sets of instruments per month.

A Boston contemporary says that Bell Telephone stock was never cheaper than at present. The business of this company is not protected by one, but by more than one thousand patents. Of course the prime patent is the broad claim of Bell to the transmission of speech by electric current, and though yet to be passed upon by the Supreme Court at Washington, there is little fear that Judge Lowell's clear-cut decision will be overruled by the full bench. Judge Lowell said in his decision against the Dolbear claim:

All the evidence in this case clearly shows that Bell discovered that articulate sounds could be transmitted by undulatory vibrations of electricity, and invented the art or process of transmitting such sounds by means of such vibrations. If that art or process is the only way by which speech can be transmitted by electricity, that fact does not lessen the merit of his invention, or the protection which the law will give to it.

How completely all experimenting claimants of recent years, represented by the Drawbaugh people, are shut off may be seen from the following statement of patent law in the Howe sewing-machine case. The Court here held—

A machine, in order to anticipate any subsequent discovery, must be perfected, that is, made so as to be of practical utility, and not to be merely experimental and to end in experiment. The terms, "being an experiment," and ending in "experiment," are used in contradistinction to the term, "being of practical utility." Until of practical utility, the public attention is not called to the invention. It does not give to the public that which the public lays hold of as beneficial. If it is an experiment only, and ends in experiment, and is laid aside as unsuccessful, however far it may have been advanced, however many ideas may have been combined in it, which subsequently taken up might, when perfected, make a good machine, still, not being perfected, it has not come before the public as a useful thing, and is, therefore, entirely inoperative as affecting the rights of those coming afterwards.

W. J. Cole, one of the superintendents of the Southern Bell Telephone Company, in charge of the Atlanta Division, has made, during the two years just past, an excellent showing. The total number of subscribers in this territory when he assumed charge was 390; it now numbers over 1500, and the monthly increase will now compare favorably with that of any other locality.

General Superintendent Carson, who has returned from a tour through this territory, reports everything prosperous and encouraging in every particular. The other divisions in his territory, under the charge of Superintendent Easterlier and Assistant General Superintendent McCluer, show an equally rapid growth.

A new corporation, under the title of the New England Telegraph and Telephone Company, is now making a location between Boston and New York for a line of private wires for bankers' and brokers' use.

The Hudson River Telephone Company.

A COMPANY COVERING THE WHOLE HUDSON VALLEY — MANY EXCHANGES AND LONG CONNECTING WIRES.

The first annual meeting of the stockholders of the Hudson River Telephone Company was held at its office in New York on Thursday last. This company was originally formed by the consolidation of the companies owning and operating the local exchanges at Poughkeepsie, Newburgh and Fishkill, when it was known as the "Hudson River Telephone and Telegraph Co." It subsequently acquired other territory and was extended by consolidation with the Westchester and other companies, until it now controls the telephone business of all the counties on the Hudson River, and some distance west of it, with the exception of the cities of Albany, Troy and Kingston, and it owns a large interest in the Albany company. It also controls one or two counties in Pennsylvania, and one or two in New Jersey, having probably the most valuable territory for the future development of the business that can be found anywhere in the country.

The company owns and operates exchange systems at Amsterdam, Canajoharie, Catskill, Ellenville, Fort Plain, Gloversville, Honesdale, Pa., Hudson, with branches at Valatie and Chatham, Middletown, Mount Vernon, Newburgh, with branches at Fishkill, Cold Spring, Garrisons and Cornwall, New Rochelle, Nyack, Peekskill, Port Jervis, Portchester, Poughkeepsie, Schenectady, Sing Sing, Tarrytown, White Plains and Yonkers. It also owns an interest in the Albany Exchange, which is a very large and profitable one, and to which the "Union Telephone and Telegraph Company" is tributary, covering Saratoga, Warren and Washington counties. In all, the company has nearly 3,500 telephone exchange stations under its management or tributary to it. Nearly all these are connected by lines over which subscribers can converse, from one exchange to another, and which extend to other places outside of the territory named. Troy and Kingston are independent, but thus connected.

The business of communication by telephone from city to city over these lines is yet in its infancy, but is rapidly growing, and is destined to rival the business of the telegraph. This company owns about 600 miles of poles and over 1,000 miles of wire line. Only one short link, from Peekskill to Garrisons, is needed to make the line complete from New York to Albany, and this will be supplied in the spring. We already talk with Albany and Troy at pleasure, and there is no reason why we cannot communicate with New York with equal ease, and the amount of business that will pass over the lines between the river towns and the metropolis will be enormous.

At the meeting on Thursday the following directors were chosen: James Bigler, Theo. N. Vail, Chas. R. Truax, Andrew B. Uline, Charles S. Beardsley, Dexter A. Smith, H. L. Storke. At a subsequent meeting of these directors James Bigler was elected president, H. L. Storke secretary and treasurer, and Andrew B. Uline general manager.

The financial statement made was very satisfactory. The capital stock is $2,000,000, of which $1,700,000 has been issued. The company owes no debt, but has about $100,000 cash on hand for use in making future extensions, constructing new lines, &c. It is earning and pays seven per cent. dividends, and will doubtless increase these as the business grows.

There is much discussion in a quiet way about increasing the dividend rate of the American Bell Telephone Company. The company is now paying 3 per cent. quarterly the 15th of January, April, July and October. There was an effort to have the January dividends increased from three to four per cent., but the conservatives carried the day, and 3 per cent. was declared. The next dividend will not be declared before the latter part of March, but discussion over it is in order for "outsiders." The company is earning more than 16 per cent. per annum, and while some of the directors are in favor of paying to the stockholders more nearly what the company earns, others are in favor of accumulating a handsome surplus. It is understood that the directors are about evenly divided upon the question of making the quarterly dividends 4 per cent. instead of 3.

The Wisconsin Telephone Company.

EXCELLENT MANAGEMENT AND GREAT PROGRESS—THE NEW CENTRAL OFFICE AT MILWAUKEE.

Probably the most extensive telephone system in the Northwest is that of the Wisconsin Telephone Company, and a more perfect telephone exchange cannot be found in the country. The new quarters, in the building purchased by the Telephone Company last spring, No. 424 Broadway, are roomy, convenient and complete, the entire space of the four floors being utilized. The building was purchased by the Wisconsin Telephone Company last spring, since which time the work of fitting it up and getting it ready for occupancy has been continually going on. Milwaukee's first telephone exchange was established in May, 1879, by the Milwaukee Telephone Company, with a list of forty subscribers. The second exchange was brought into existence in December, 1880, 414 subscribers. The present exchange, "planted" Oct. 5, last, has over 1,000 subscribers. It employs a manager, three assistant managers, thirty-two operators, one chief inspector, four assistant inspectors, two linemen, one superintendent of construction, seventeen construction men and one battery man. These people are all employed in the Milwaukee exchange, exclusive of the 500 or more who are employed by the company in running the 58 exchanges in the State. The company now has about 100 toll lines in operation, and others building. Of this number three-fourths of them are

TRIBUTARY TO MILWAUKEE.

Among the cities and towns thus connected, as shown by the company's list, alphabetically arranged, are Appleton, Berlin, Burlington, Cedarburg, Chicago, DePere, Delavan, Elkhorn, East Troy, Fond du Lac, Green Bay, Jefferson, Kenosha, Lake Mills, Lake Geneva, Menasha, Marquette, Neenah, Oconomowoc, Oshkosh, Port Washington, Racine, Spring Prairie, Springfield, Waukesha, Waupun, West Bend, Watertown, and scores of other smaller towns. In all there are about 1,200 miles of toll line, and at least 75 toll stations where no exchange exists. When the few exchanges in the State were consolidated and taken in hand by the Wisconsin Telephone Company, July 1, 1882, they numbered but 17. To-day the company has 59 exchanges, with about 3,700 subscribers. The toll-line service is being received with great favor wherever it has been established.

and repeated calls for an extension of the lines are being made. A line is being run to Black River Falls, in the LaCrosse system, and others will be run into the lumbering districts of Northwestern Wisconsin as fast as men can get to the work. One of the latest and most valuable toll lines planted is that

TO CHICAGO.

For this a large wire has been used, and is working "perfectly lovely," as one of the lady operators in the toll-line office yesterday expressed it. The ground floor of the Telephone Company's building is utilized for a repair shop and supply store room, with a public telephone station in front. The entire second floor is given to the general offices of the company. On the third floor are neatly furnished toilet rooms for the operators, a battery room, stationery, supply storeroom, etc. The entire upper, or fourth floor, is occupied by the central telephone office, with the manager's office and the toll room in front. In the central office one witnesses about as lively a scene of never-ending clatter as could be found. There, before the switch-boards are seated a score of pleasant young ladies, attending to the calls of 1,000 telephone subscribers in the city.

THE NEW SYSTEM

thoroughly fills the bill. In the new office are five switch boards, multiples of each other, the wire of every subscriber in the city being connected with each board. At either of the boards are three operators, each attending to a certain number of subscribers. The "running up and down the line" practice is entirely done away with, operators sitting in front of the switch-boards, and without leaving their seats connecting any two subscribers in the exchange. Under the new system, if subscribers will observe the rules published in the last telephone list, or directory, connections will be made in one-half the time previously occupied. Under

THE NEW ORDER OF THINGS

a subscriber is requested to ring, take his telephone, make known his wants, and wait for an answer through the telephone, instead of "ringing" from the central station, as formerly. A. wishes to talk with *The Sentinel* office. He rings up the central station, immediately places the telephone to his ear, when the central office will answer by speaking instead of ringing back, as has been the practice. A. then asks for No. 16 (The *Sentinel* office's number), still keeping the telephone to his ear. The operator rings up No. 16, connects its line with A's, and the *Sentinel* office then speaks direct with A., without further ringing. If patrons will observe this rule, they will find that connections will be made in less time than it takes to read the above plan of operation. When done talking, A., the originator of the call, hangs up his telephone and gives one short ring. The operator at the central office will at once ask: "What is wanted?" and if no reply is given it is taken for granted that A. has no further use for the line at that particular moment. If, however, A. desires another connection he says so at the time the inquiry is made from the central office, and it is given to him at once, without the delay of from five to ten minutes, as was likely to be the case under the old system. The new system has been in operation only two days, but it is working admirably, and will be much better as soon as patrons thoroughly understand it and adhere to the rules as given in the Telephone Directory, which every patron has. Particularly is it important, to the proper working of the new system, that when a subscriber is called by the central office he immediately takes down his telephone and replies by speaking instead of ringing.

To form any correct idea whatever of the complication necessary for satisfactory work and the amount of work and care required in moving such a large exchange as that of Milwaukee a person must visit the establishment in person and see for himself.

THE WIRES

of every subscriber are first brought to a frame on the roof of the building. Running into a roomy cupola, they there come in contact with a system of lightning arrestors, for sifting out atmospheric electricity. Here, upon a large frame, can be seen every wire of the exchange, crossed and recrossed, woven and interwoven. From this frame they are run into cables, and passed through the roof into the operating room, or central office, and then follow each other through the several switch-boards, each wire ending at its own annunciator. Connecting the five switch-boards are over 14,000 wires, all connected and soldered at each end to its proper place. In an adjoining room, as above stated, is the switch-board of the toll lines, by which Milwaukee is connected with adjoining cities and towns. Running under the floor between the toll-room and the central office are a number of wires, cabled, which are termed trunk lines. When a subscriber wishes to converse with any of the outside towns, he asks the operator at the central office for the toll room. The operator makes a connection with the toll room by one of the trunk lines, and the operator in that room in turn speaks direct to the subscriber, ascertains his wants, and makes the proper connection with Chicago, Racine, Fond du Lac, or other exchange, as the case may be.

A Chapter in the Drawbaugh Case.

The facts in the case of Drawbaugh *vs.* Blake and Edison, recently passed upon by the Secretary of the Interior, illustrate the often repeated and eagerly pursued policy of treading so fast upon the heels of an opponent as to unconsciously walk right into the mud and mire wished to be avoided. There is such a thing as being too eager, and, in consequence, of overlapping ourselves.

We *all* have heard of Drawbaugh, the man who was so poor during the years he claims to have invented the art of transmitting speech by electricity, that his cash receipts from other inventions were only about $10,000, who had real estate from which he derived an income, and was so fortunate in his poverty as to have friends who raised $35,000 to exploit his inventions—not telephonic—we have heard considerable of this case of penury where it was an impossible thing to raise $15 for a caveat to protect the *greatest* invention of our time, of which a parody of familiar lines truly illustrate: "Thousands for faucets, pumps and mill-stone tools, but not a cent for telephones." The name of this man is becoming a household word, this man who was so ignorant of his *own* rights that he did not know how to proceed before the patent office, and yet who had advertised himself as a patent solicitor and model maker, and so acted for inventors in his own neighborhood. Who, also, had not proper tools with which to make suitable telephone models and yet had at his command a machine shop full of tools with which the faucets, &c., were made.

This man with all these resources at his command and with such perfected models as he now shows, waited until July, 1880, before he found out his friends, money and courage, to apply for a patent. By this time Bell had all the patents, all the money he wanted to carry on business with, and could count by over a hundred thousand the telephones in use, all paying such a royalty that the Bell Company were dividing with their stockholders 8 per cent. dividends, and laying by a large surplus to estabish their plant.

In this application for a patent he had the colossal assurance to claim the broad principle of transmitting speech by electricity. In view of the facts, it is a matter of local concern that Mr. Randall, M. C, of Penn., should be interviewed and be made to see that his State does not need so much tariff protection on *iron* as it does on *brass*. It is a matter of record that this application was refused, by the patent office, on the ground that the Bell patent had been in public use for over two years, the limit fixed by United States statute.

This was a terrible set back for the parties, as no doubt the prime object was to get a standing before the patent office. If they could only be put into interference with the Bell patents to that extent they were on an equality with him. But, as we see, their fond hopes were dashed to the ground.

Now, the next thing they did, in point of importance, was as much different from their first position as an elephant is from a mouse. In casting about what they could do under these circumstances, they divided their original application and made what is known as a divided or split application, in which they laid claim to what is known in the Blake transmitter as the damper spring, a small finger-shaped steel spring, one end of which rests upon the diaphragm of the transmitter, its purpose being to dampen or check the undue vibrations of the same. In due course of time an interference was declared between Drawbaugh & Blake. The former moved, that as his claim was for the broad principle of the dampener, and Blake's only for a device, the interference should be dissolved and a patent issued to him. This motion was granted by the examiner in charge, and if the matter had been allowed to rest here, Drawbaugh would have received a patent covering the idea of dampening the diaphragm of a telephone, and it would, of course, have been a most valuable thing for the People's Telephone Company. In view of this there was great joy in the camp; they hugged and congratulated themselves that they had a big thing now. A flourish was made of the immense receipts they were to obtain from the Bell Company, in the shape of royalties, as the thousands of Blake transmitters would be tributary to their patent—for the use of the indispensable damper spring.

But their joy was brief. Blake appealed from the Examiner to the Commissioner of Patents, who reversed the former's decision, and held that Blake was a proper party to the interference, as his claim was as broad as Drawbaugh's.

Now, who should come forward and make this a *three*-cornered sociable but Edison, and demand that *he* should be made a party to the interference, as his earlier applications showed a dampening device? Edison's motion was denied, and appeals have been taken by this trinity until they arrived at the desk of the Secretary of the Interior—the tribune of last resort for them. Drawbaugh all the time contending that those bad boys, Blake and Edison, should be declared out of interference and a patent issued to him, while they claimed they were proper parties of an interference.

The Secretary has decided that their claim is good, and that Drawbaugh's is not.

On the face of the matter all this does not seem so bad or out of the way; it seems fair that a case should be settled by evidence, and a patent be allowed to rest in the direction of the best proofs. But the issue lies deeper than the surface. Drawbaugh is like the defendant in court, he was extremely uneasy, and showed his anxiety to his counsel, who said to him, "Don't be afraid; I will see that you have justice done you." "Yes," said the defendant, "that's what I am afraid of; it's not justice I want."

The peculiar feature of the case, and what makes it so galling to the Drawbaugh side is this. When Blake alone was a party to the interference, Drawbaugh stood a fair show to prove priority of claim, as Blake's earliest date would be somewhere in the latter part of 1878; whereas Drawbaugh would put in evidence his celebrated model of 1878—a model, by-the-way, which not only shows the damper spring, but also all the fine, delicate and intricate improvements, which were only reached in the Blake transmitter by years of careful experiment by several skilled electricians and mechanicians. How the poor, ignorant Drawbaugh, without proper tools or friends, could accomplish such things surpasses the *tales* of Arabian Nights.

If they had allowed the matter to rest they might have had some chance, but they made such a drop from the broad claim of the art of telephony, to the claim of a simple adjunct; that they could not stop dropping, as it were.

But that now Edison is made a party to the interference, the case assumes a phase not agreeable to the parties who have been so eager to follow up and own telephone patents, and broad patents, too; for Edison carries his dates of invention so far back as to compel Drawbaugh to substitute for his 1878 model one claimed by him to have been made prior to the Bell patent. This, of course, opens up the whole question of the invention of the art of telephony, and to practically try the New York case in the patent office.

So we have to record another set back for Drawbaugh; and after all the turnings and twistings for advantage, all the People's Telephone Co. have, after these years of endeavor, to show their anxious stockholders are, the Klemm and Tisdale patents, a lawsuit in New York, a contention in the patent office, and a public opinion, at first in their favor, perhaps, but now setting as a strong tide against them, as it became educated by the real facts becoming known. LISPIER.

ROCHESTER, N. Y., Feb. 18th, 1884.

Editor of Electrical Review:

DEAR SIR:—I embrace the present offered opportunity and pen to you what I know about electrical matters in Rochester. The telephone company here has about 400 city lines and 650 subscribers, besides nine trunk lines, three of which end at Buffalo, a distance of 70 miles by rail, and about 90 *via* lines.

The city lines are built mainly of Nos. 12 and 14 galvanized wire; the trunk lines, with one or two unimportant exceptions, of No. 9 galvanized. By means of the lines the company has an established connection with 130 cities and towns, the nearest point being six, and the farthest 130 miles away by line. The last mentioned line ends at Dunkirk, and I myself have distinctly heard the operator whisper from that place; so you can draw your own conclusions as to the manner in which our lines are constructed. Standards are used mainly for conveyance, though there are a number of fine pole lines. Post & Co.'s exchange system is used, and although Rochester lays no claim to having "the" exchange, still, in point of service, she must gently but firmly ask to be placed with the first. We differ with an exchange not long ago mentioned in your paper, in that it is the *first* duty of the operator upon arriving in the morning to thoroughly test their wires, so that by 8 o'clock Mr. Blackall, the able superintendent, generally knows "what's what." One of our operators spilled a drop or two of water between the motor strip and subscribers' line, and consequently there was a small fire. Not relishing the appearance of things, and naturally enough supposing that water must quench fire, she immediately converted her mouth into a hydrant, and using her lips as motive power, poured as large a stream as circumstances would admit around and about that "secluded spot," until about one-third of her table was ablaze. You can't make her believe now that water is harmless. The town of Canandaigua served an injunction on the Empire State not long ago, restraining them from setting any more poles. They had set a few down the main street. A suit followed, of course, and the prosecution was finally narrowed down to the following cause for complaint: "That at some future time the icicles that must necessarily form on the wires *might* drop on the heads of horses which were hitched underneath, and thereby frighten them. Icicles form on No. 12 galvanized wire strung horizontally. Bright idea, was it not? The exchange there is now booming. I was called, not long since, to a prominent manufacturer's to move a ground wire alleged to be in the way. Not seeing cause for complaint, I asked the engineer why he wanted it moved. He said that "they had stood it as long as they possibly could; that you could not approach the belting of the machinery without experiencing a visible shock, and 'that ground wire must go.'" It was a private line. Frict. elec. Will try and procure some electric light news for next letter. J. M. M.

The Betts Ready-made Wire Fencing Company, at Palmer, has just begun operations. It will produce 22,500 rods of fence per month.

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Give Us the Facts or Give Us a Rest.

Our esteemed contemporary, the London *Journal of Gas Lighting*, which knows all about gas, but insists upon talking about electricity, with which it is by no means conversant, has now reached a point where it is really the duty of its friends to interfere. Instead of trying to explain why so many fatal accidents are continually resulting from the use of gas, it looks with a ten thousand magnifying power-glass all over the world, and, finding that one man has been killed by electricity in the United States, it expatiates upon this terrible holocaust, ringing the changes upon the accident and begging us to regard it seriously. Having now sickened of this somewhat small business, it has flopped over on the comparison business again, and is at its old and somewhat transparent game of comparing the poisonous fluid, for which it so incessantly and tediously toots, to the electric light, to the latter's advantage. What we want are facts. If it will name lighting stations and systems, then we can inquire as to the correctness of the *Journal's* assertions, which we must confess we have not infrequently in the past found to be gross exaggerations.

The *Journal of Gas Lighting* may live to see the day when its favorite illuminating fluid is used for little else but a fuel, and its editor, unless in the meantime he inhales some of his own gas, will at a not far distant day be found writing on the value of coal gas as a fuel, while a group of incandescent lights throw a soft, steady and brilliant light over the desk at which he is at work.

More Interesting Features of the Cincinnati Exposition Awards.

In our contemporary, *Science*, for February 15, 1884, just received, we notice a long anonymous article headed "Tests of Electric Light Systems at the Cincinnati Exposition." Having heard that an injunction had been granted restraining the Commissioners of this Exposition from making their proposed awards in reference to electric light systems, on the ground of the inaccuracies and unfairness in the tests and report of the jury charged with this subject, we were somewhat surprised to see this publication while the litigation was still pending, and read it with interest to see what ground it might show for the claims on which the injunction was granted.

Even a hasty perusal was sufficient to show that if, as seems probable, this article is substantially the report complained of, it certainly furnished sufficient grounds for the injunction already granted, and is likely to do little credit to its author should his name become known.

Thus it appears, in the first place, that in making their tests, this Cincinnati jury relied exclusively on a single method of measuring the electric energy in the circuits experimented upon, and neglected utterly all the usual checks and safeguards against error which are commonly applied.

For example, it does not appear that a single measurement was made of the resistance of the armatures or field circuits of the machines, or of the external circuits, though such measurements may easily be made with an accuracy far greater than can be attained with any other electric measurement.

Had such measurements been made in the present case, they would at least have saved this jury from so extraordinary a statement as that which they have made as to the efficiency of the Edison machine, and which amounts to no less than the assertion that the Edison machine developed as electric energy about six per cent. more than it received from the belt by which it was driven.

Incredible as it may seem, it is actually true that the author of this article and, according to him, the Cincinnati jury, at this late year of the nineteenth century, calmly make a statement which, if true, implies *the realization of perpetual motion in the Edison dynamo-electric machine.*

It is manifest that this is done blindly for lack of knowledge of the existing conditions, and of what is necessarily implied in the expressions used; but the absurdity is all there, and manifest to any electrician who knows the facts familiar to every one interested in such matters, except as it would appear to this unfortunate jury.

The statement to which we allude is briefly this: The Edison machine showed a percentage of efficiency—that is, a relation of electric energy developed in the exterior circuit to the mechanical energy expended upon it—of from 95.0 to 95 2 per cent.

Now the things unknown to this jury, but otherwise well known, are the following: The resistance of the field circuit in these Edison 250-light machines, which is about 13.84* ohms, and the resistance of their armatures, which is 0.41* of an ohm.

From the first of these data it follows that, if 95.2 per cent. of the applied energy appeared as current in the circuit, 6.8 per cent. must have been supplied to the field circuit, making for these two items 102 per cent.

From the second fact, namely, that the armature resistance was .041 of an ohm, it follows (taking into account the above results) that if 95 per cent. of the applied energy was found in the exterior circuit, 4.4 per cent. must have been expended in the armature coils, making a grand total of 106.4 per cent. of electrical energy developed in and by this wonderful machine from a poor 100 per cent. of mechanical energy applied to its driving pulley, and this without any allowance for friction, resistance of the air, or other necessary sources of loss.

These relations may be otherwise expressed as follows: The Cincinnati jury find the electrical horse-power developed in the exterior circuit of the Edison machine in a certain experiment test or "run" to be 20.9 H. P. At the same time the electromotive force was 124 9 volts. With this E. M. F., if the resistance of the field was 13.84 ohms, the current through it would of necessity be 9.02 ampères, which, in such a resistance, would expend an energy of 1125 Watts, or 1.5 H. P. The armature manifestly must carry this 9.02 ampères of current in addition to the 124.7 ampères which the jury found in the exterior circuit, or in all 133.72 ampères. This current, in a resistance of .041 ohms, would expend an energy of 733.312 Watts or .98 of a H. P. We have therefore

Energy found by jury in exterior current	20.9	H. P.
Energy which must have been expended in field	1.5	"
Energy which must have been expended in armature	.98	"
Grand total of energy developed.	23.38	H. P.
From an actual mechanical energy of	21.96	"
Energy created by dynamo	1.42	H. P.

This also takes no account of the necessary losses by friction and resistance of the air and other causes, which would in all probability bring up this creation of energy to over two horse-power, or a round ten per cent. of the power used.

Such a result as this will, no doubt, delight the heart of Mr. Keely, and make him feel that he is not without the support of concordant opinion and analogous results.

Turning back from such a result as this, we are not surprised to find that the two instruments on whose indications absolute dependence is announced in these tests, were simply *assumed* to remain correct even when the introduction of numerous electric circuits into the room where they were used had caused a considerable relative discordance to show itself in another instrument, and were only calibrated some time afterwards at a distant place, with entirely different surroundings.

Passing next to the photometric measurements of the incandescent lamps, we see another marvelous performance. In place of measuring the several lamps against standard candles, as is usual, the two lamps to be tested were placed at opposite ends of the photometer, and were then run at very different luminous intensities, neither of which was known except as related to the other.

One—the Edison—was run by a special dynamo during these tests, and manifestly beyond its regular intensity, as appears from the electromotive force stated, *i. e.*, 118 to 116 volts, the normal being 100, as announced by the Edison Company.

The other—the Maxim—was run much below its normal intensity, in consequence of the fact that the machine supplying it was on the dynamometer, and driven from a pulley supplied by the jury, which was by mistake made too small, so causing the rate of the machine to be only 1,030 revolutions, in place of 1,060 to 1,075, which was the rate at which it had been run while in its normal location during the exhibition.

The utter unfairness and absurdity of comparing two incandescent lamps, when one was run above and the other below its normal intensity, could only have escaped the perception of a very inexperienced or inconsiderate person, as we should suppose; but it does not even yet appear to have penetrated the brain-pan of the writer of the article now considered, or he surely would not have exposed himself and the Cincinnati jury to the ridicule of all instructed electricians and intelligent people generally, by the publication of such a farcical record as he has given in this connection.

The article under consideration is replete with other indications of inaccuracy or unfairness, but we have indicated, as we think, quite enough to explain the action of the Court in granting the injunction restraining the Commissioners from making any awards on the basis of such a report, and to make it seem probable that this injunction on a further hearing will be made perpetual.

* These are in each case the lowest figures given in the Munich report.

Electricity Used as a Mode of Locomotion.

About five years ago news was wafted across the Atlantic to us that Dr. Siemens had succeeded in running a motor used to propel itself at a distance from the generating machine by means of an electric current conducted along the rails.

In 1859, Congress made a grant to Dr. Charles G. Page of $20,000 for the purpose of testing the capacity and usefulness of the electro-magnetic power as a mechanical agent to be applied to the purposes of locomotion and navigation, and the probable cost of the same. Dr. Page took this in hand, and made it the subject of a very careful research. He converted the electric energy into mechanical motion by means of a helix, and an iron cylinder free to move in it; the alteration of the currents through the helix producing a reciprocating motion, which is transformed into a circular motion, as in a steam engine. This he first applied to a stationary engine, capable of giving two horse-power. He afterwards constructed a locomotive in which the steam cylinder was replaced by the helixes, and the boiler by zinc and carbon batteries. With this locomotive a speed of nineteen miles an hour was reached. Farther than this, he recognized the advantage in having the magnets arranged so that they, by their repulsions and attractions, would cause a motion of rotation, which could be transferred to the axle of the locomotive. This is the common feature of all the electric locomotives of to-day. The objection to this was an economic one. As zinc costs about 20-fold that of coal, weight for weight, and 200-fold that of coal for equal quantities of potential energy, we can easily see why this was not a financial success.

The problem before us to-day is the ease in which we convert coal into an electric current, and this is one of the departments of applied electricity which has been making such remarkable strides within the last few years.

The present electric locomotive differs little from that of Siemens & Halske exhibited at Berlin in 1879. The road for the electric locomotive does not, in Mr. Edison's system, differ much from an ordinary tramway. On close inspection, however, it is found that where the rails would come in contact with the cross ties they are both insulated by being painted with a compound consisting principally of asphaltum. The spike which fast-

ens the rail to the cross-tie is also insulated, where it would touch the rail, by a piece of leather. This road is not ballasted as deeply as is ordinarily the case. With these precautions, a remarkably good insulation is obtained. In dry weather we have found the resistance between the rails to be as much as 29,000 ohms per mile. To insure the rails making a continuous conductor, a piece of copper sheeting is placed between the fish-plate and the rail, before it is screwed up; which, when the nuts are tightened, offers very little resistance. If care be taken in all these particulars, a road constructed with a thirty-eight pound rail ought not to measure more than .128 ohms to the mile. The great objection to this road is that it debars all ordinary rolling stock, for the positive and negative rails would be connected through the metal wheels and axle. Dr. Siemens avoids this by laying a central rail for the current alone, using the two ordinary rails for the return circuit. This central rail is usually elevated a little, thus making the insulation much better, and the total cross-section of the conductor will be greater than in the case just mentioned where only two rails are employed, consequently the resistance is less. In this road there is a very neat way of meeting the difficulty when the track is crossed by a wagon road; at this point the central rail must be abolished, and so two roller contacts are placed on the car, one at the forward and one at the back end, so that the motor, as it passes a gap like this, is kept in circuit by the back contact, while the forward contact with the central rail is broken; as soon as the forward contact is re-established on the central rail the back contact can be broken, thus never cutting the electrometer out of circuit.

In the mines of Zankerode, Saxony, the electric railway is competing successfully with horseflesh in the transportation of men and materials. It has been found in using the electric motor for this purpose it is best to fasten the conductors to the roof of the tunnels, the constantly wet roadbed making insulation next to impossible. Two inverted tee rails, insulated from one another, are used as conductors; and by means of two sliding contacts and flexible conductors the electromotor is put in connection with the rails.

Passing to the consideration of the electric locomotives which are working now on practical roads, we find that a number of them, such as the one belonging to the Electric Railway Company of the United States, that was running at the Chicago Exposition, and that one near Mr. Edison's laboratory at Menlo Park, are simply dynamos used as motors, mounted on a platform car, and connected to the axle of the wheels by any convenient means. The wheels are insulated from the rest of the car by bolting inside of them a disk of hard wood, made to fit well, and then mounting them on a lathe and cutting a groove out of the face of the wheel until the wood is reached; in this way they are insulated from the rest of the car. The current is collected from the rails by brushes resting on the rim of the wheels, and is delivered to the negative rail in the same way. The current is first carried to a switch, so arranged that by moving a handle in one direction the armature makes the car go ahead, and in the opposite direction makes the car go backward, and in passing from one to the other cuts the machine out of circuit. The connection of the armature with the axle of the car gives a good deal of trouble; frictional gear has been tried and proved a failure, and to use a belt here, we think, is the misapplication of a very good thing, for we have a small mass at a high velocity to effect the movement of a large mass at a proportionate velocity; and before the armature of the dynamo has brought the wheels of the car to its normal velocity, the belt has to slip to make up deficiencies. We have witnessed one experiment where an assistant was required to sprinkle the belt with rosin; besides this loss of power the depreciation of a belt under these conditions is very rapid. The Daft Electric Company, of Greenville, N. J., have constructed an electric locomotive with a special motor, the armature of which is wound directly on the axle of the car wheels. It seems to us that this is a beginning in the right direction.

There are numerous applications of electricity that have been suggested in regard to the motor, such as having strong electro-magmagnets to pull the breaks to the wheels, when the current is thrown through them; and to have two large electro-magnets fastened to the car, one over each rail, with their faces just clearing the rails; in climbing up steep grades a current is passed through them, and their attraction to the rails will increase the traction of the electric locomotive. The current can also be used for illuminating the cars. Mr. Edison applied to his car at Menlo Park what he called a hill climber. It was a clutch—so arranged as to slide forward on the rails easily, but clutch on being pulled backward. These are attached by an arm to two cranks which revolve above the rails, and can be put in gear from the dynamo when the grade is reached, and as the cranks revolve forward the clutch is thrust forward on the rail, and the crank, on its backward movement, pulls the car forward. With this attachment the motor was made to go up a grade of one in six.

It has been stated that having the two conductors exposed would be a source of great danger; persons liable by accident to touch both rails at the same time. My experience has not tended to confirm this statement. I have touched both rails with my two hands at the same time, when the electric locomotive was running 100 yards away, and only felt a slight tremor through my arms. The E. M. F. was at that time about 90 volts.

The dynamo used as a generator has by experience been brought to a higher point of efficiency than any transformer of energy we have. In some tests made at the late Paris Exposition a dynamo was made to return 93 per cent. of the power applied to the pulley in the form of an electric current. This is about the limit we can hope to attain. It is true that the dynamo is a reversible machine, but the very fact of its being a generator interferes with its action as an efficient motor. When it is used as a motor the wires of its armature still cut the magnetic field and produce a current which opposes the current that revolves the armature. A. Bondsept gives a forcible illustration, based on the most striking of the mechanical analogies to electricity: "For instance, the phenomena attending the electrical transmission of power are absolutely similar to those observed when two centrifugal ventilators are in action. The one being actuated by some motor, and the other receiving its motion from the air emitted by the first; the two being connected by a conducting pipe along which the air is transmitted. The inherent weakness of such a system is seen at once; the fans acting by the centrifugal force developed, and emptying themselves into the same pipe, a portion of the energy of the motive current is uselessly expended in overcoming the inverse current generated by the receiving fan." The same effect takes place in a circuit with two similar dynamo machines when one is used as a motor, thus having a nullifying effect on each other, and consequently the resultant power at the receiving dynamo is merely the difference between these two actions. Here is a large field open to inventors, the making of a motor in which the counter electromotive force is reduced to a minimum. The receiving machine might be furnished with a shunt circuit, or condensers placed in such a way as to prevent the generation of the counter electromotive force in the circuit connecting the two machines.

The whole question upon which the success of the electric railway turns is the single point whether we get the most economical results by burning the coal directly under the boiler of the locomotive, or by burning it under the boiler of a stationary engine, thus transforming it first into an electric current and then reconverting it into motion, after having overcome the resistance of the track. I will, in presenting figures on this point, consider the electric locomotive working under the most unfavorable conditions, and the steam locomotive under the most favorable.

We will assume that the efficiency of conversion by means of the dynamo is 90 per cent, after overcoming resistance of the leaders to the rails; we will find 87 per cent. available on the line; 69% of the energy given to the dynamo is returned in work by the electric locomotive.* Say, that under the influence of wet and foggy weather the loss by leakage from the conducting rails will reduce this to 50 per cent. A Porter-Allen high-speed engine will, running the dynamo, develop one indicated horse-power for 2½ lbs of coal. The electric motor will give, then, under these conditions, one horse-power for 5 lbs. of coal. An ordinary locomotive is well known to be the most uneconomical steam engine we have. On the English roads engineers estimate 12 lbs. of coal to produce one horse-power; but, taking in consideration good firing and well-proportioned draft and grate surface, this has been reduced to 9 lbs. on local trains. These figures show that it requires the consumption of five-ninths the amount of coal to run an electric locomotive, under the most unfavorable conditions, that it requires for a steam locomotive, under the most favorable conditions.

Another advantage, which the electric locomotive has over the steam locomotive, is its cheapness and lightness of construction, having none of the dead weight of the boiler, water and fuel to carry. It has been stated by engineers who should know that 30 per cent. of the power used for transference of freight and passengers is absorbed in moving the mass and overcoming the friction of the reciprocating parts; and the speed to which an electric locomotive can be driven does not depend on the velocity with which these reciprocating parts can move, as in a steam locomotive. In a paper read before the Society of Arts, presented by Alexander Siemens and Edward Hopkinson, an estimate is made of the comparative cost of working, first, a steam locomotive, and afterwards an electric locomotive, on a railway built at Portrush, Ireland: "The steam locomotives were made by Messrs. Wilkinson, of Wigan, whose engines are considered as satisfactory as any. They have a pair of vertical cylinders 8" in diameter and one foot stroke, and working at a boiler pressure of 130 lbs. The total weight of the engine was 7 tons; the electric car, with which the comparison is made, has a dynamo weighing 13 cwt., and the tare of the car is 52 cwt." The figures in the result that he draws are manifestly incorrect, which prevents me quoting the paragraph entire, as I should otherwise do.†

A typographical error, as this probably is, should, however, not vitiate the results of the work of such a man as Siemens.

Finally, compare the following estimates of costs from actual experience on this road, taking the average of a week's costs:

	£	s.	d.
Driver's wages	1	10	0
Cleaner's "	0	12	0
Coke, @ 25s. per ton, 53 cwt.	3	13	1½
Oil, 1 gallon, @ 3s. 1d.	0	3	1
Tallow, 4 lbs., @ 6d.	0	2	0
Waste, 8 lbs., @ 2d.	0	1	4
Depreciation, 15 per cent. on £750	2	3	3
Total	£8	4	9½

The distance run was 312 miles. Calculating the cost in the same way for the electrical railroad, running the same distance, is as follows:

	£	s.	d.
Wages of stoker of stationary engine	1	0	0
Coke, @ 25s. per ton, 52 cwt.	2	15	0
Oil, 1 gallon, @ 3s. 1d.	0	3	1
Waste, 4 lbs., @ 2d.	0	0	8
Depreciation on stationary engine, 10 per cent. on £300, 11s. 6d. Depreciation on electrical apparatus, 15 per cent. on £500	2	0	4
Total	£5	19	1

Which is a saving of 25 per cent. over the steam locomotive. We see, however, that he has forgotten to pay the driver of the electrical engine anything.

The stationary engine is only a common agricultural engine, which is only to be used temporarily, while they are erecting turbines to run the dynamo. When water power is used here, we will be able to strike out the first two items in the last column, which will give a saving of about 50 per cent. over the ordinary mode of locomotion.

* *Van Nostrand's Engineering*, Vol. 23, No. 6.

† MS.—He says that the "steam locomotive will pull 12 tons up a grade on this road, while the electric locomotive will pull 6 tons up the same grade; so, weight for weight, the electric locomotive will pull the most by 5½ per cent. in favor of the electric locomotive."

Electric lights have been introduced into a gunpowder manufactory in England. The buildings are scattered over two miles of territory, and the wires are carried above ground, from a dynamo near the center of the enclosure.

We learn that the Denver and the Rio Grande Railroad Company is contemplating the manufacture of steel cars in the near future. A sample car will soon be commenced at its shops at Denver. It is intended to heat the car by steam and light it by electricity.

A new form of selenium cell has been invented by Mr. Charles E. Fritts. It has the following properties: (1) Its resistance can be made as low as desired, down to 9 ohms; (2) the light is made to strike the cell in the same plane as the current; (3) it is far more sensitive to light than any before known, one cell having had 15 times as high resistance in dark as ordinary diffused daylight in a room. Subsequently he announced the discovery of a new form of selenium, quite colorless and transparent, obtained under conditions excluding everything but selenium.

Articles of association of the Relief Telegraph Company were filed in the County Clerk's office yesterday. The purpose of the company is to maintain wires connecting public offices, business houses and private residences with each other and with the company's offices. Its capital stock is $25,000, divided into 250 shares, but the right to increase to $1,000,000 is reserved. The shares of the company are held as follows: Joseph B. Yerkes, of Plainfield, N. J., 200; Robert Clark, Jr., of Brooklyn, 30; Charles Earnest Wilson, of New York, 10; and Thomas N. Morgan, of New York, 10.

The board of directors of the Gilliland Manufacturing Company of Indianapolis, Ind., have elected the following officers to serve for the ensuing year:

President, Noah H. Swayne, Jr.; first vice-president, Wm. Kline; second vice-president, C. W. Hammond; general manager, James F. Gilliland; Treasurer, J. C. McCutcheon; secretary, Wm. J. Reynolds.

Board of directors: Noah H. Swayne, Jr., Frank B. Swayne, Wm Kline, John M. Wheeler, S. C. Schenck, Toledo, Ohio; C. H. Hammond, Ernest Hilgendorf, St. Louis, Mo.; L. F. Sheldon, Sedalia, Mo.; C. Selden, Baltimore, Md.; John F. Wallick, James F. Gilliland, Indianapolis, Indiana.

The company is engaged in the manufacture of all kinds of electrical apparatus, and deals in telegraph supplies and materials of all descriptions. Its directors are prominent railroad and telegraph men.

A new submarine cable will shortly be laid between Australia or New Zealand and San Francisco, the route being through the Fiji and the Sandwich Islands. The Queensland Government also propose to lay a cable from the Gulf of Carpentaria to Ceylon or Singapore, the starting point in Australia being Cape York. Interviews have taken place in Sydney between the Postmaster General of Victoria and Mr. Warren, the representative of the Eastern Extension Telegraph Company, it being proposed to reduce the through tariff from 10s. 8d per word to 6s., in return for a guarantee or subsidy.

The block system of electric signals is to be introduced on the Lake Shore and Rock Island Railroads between Chicago and Englewood, a suburb of Chicago.

The following timely advice is given in the current number of *Combustion and Steam Power* in regard to hauling fires.

"When a boiler is short of water and a heavy fire is on the grate, what shall be done to prevent the boiler from being burned?

"The first impulse is, on the part of some, to haul the fire at once, but is not that the most dangerous course that could be taken? It seems open to criticism. A fire that is disturbed is intensely hot for a short time, at a period when no more heat is needed, and it would, therefore, seem that it would be better to open the doors and throw wet ashes on and smother the fire, instead of adding to the danger by raking it over. By so doing, the heat is at once lessened—at no time increased—and the pressure is falling, but when we haul a fire, the exact reverse occurs, more steam is made and the danger increased.

"We think it is safer to cover the fires than to haul them, particularly if they are of bituminous coal."

The American Electric Illuminating Company of Boston, are enlarging their installment of engines at Worcester, and have ordered this week of the Jarvis Engineering Company two more of the Armington & Sims engines for their stations there, making four engines of this make now in use at that place, with a capacity of 200 lights.

The Palmer Wire Company, at Palmer, Mass., turned out 3,000 tons of iron and steel wire last year, valued at $400,000. About two-thirds of the product was steel wire, and one-third of the whole was galvanized. A large proportion of the whole product was used for telephone and telegraph wire. The company has now on its books $200 000 worth of unfilled orders.

The Jarvis Engineering Company, Boston, has recently received a contract from the Fall River Electric Light Company to fit up a new station to run 100 Thomson-Houston Company arc lights in Fall River. The station will be of brick, and the boiler house is nearly finished. They will set a 66-inch by 6-foot tubular boiler with the Jarvis Furnace, and Sheffield grates will be used to burn screenings for fuel. The power will be furnished by two Armington & Sims Company engines, that will connect direct with the dynamos without using countershafting. The water from the creek will be used to feed the boiler, and a Deane pump and Korting injector will supply it to the boiler. The station will be so arranged that it can be increased indefinitely by adding more boilers and engines.

The demand for the automatic cut-off engines built by the Buckeye Engine Company of Salem, Ohio, has very largely increased recently. They have within the few weeks last past received the following orders for engines for electric lighting purposes as follows: 16″x32″, 156 horse-power, for Palmer House Company, Chicago, Ills.; 9″x14″, Lincoln Park Electric Company, Lincoln Park, Chicago, Ill.; 15″x30″, Winona, Mass., Electric Light Company; 14″x16″, speeded at 220 revolutions, Electric Light and Gas Company, St. Paul, Minn., takes the place of two 10″x16″ straight line engines; 11″x22″, Sioux City, Iowa, Electric Light Company; 11″x22″ Merchant's Electric Light Company, Moline, Illinois; 14″x28″ Elgin, Ill., Electric Light Company. Some of our other orders, are 15″x30″, Ogden Milling Company, Ogden, Iowa; 15″x30″, Owensboro, Ky., Wagon Manufacturing Company; 16″x32″, Chippewa, L. and Boom Company, Chippewa Falls, Wis.; 26″x36″, The Laird Motor Lumber Company, Winona, Mi-souri; 13′x26″, Francis Axe Company, Buffalo, N. Y.; 20″x40″, Bodley Bro.'s Wagon Factory, Wheeling, W. Va.; 16″x32″, Alex. Smith & Son's, Carpet Company, Yonkers, N. Y.; 14″x20″, Snelbyville, Tenn, Wagon Manufacturing Company; 26″x36″, C. N. Nelson Lumber Company, Lakeland, Minn.; 12″x24″ Woodruff & Son's Stove Works, Salem, Ohio; 2—, 7″x14″ for Sampson Sons, Brooklyn, L. I.; 22″x33″ for Godfrey & Clark, Paper Mills, Pittsburgh, Pa.; 14″x28″, for Pray Manufacturing Company, Minneapolis, Minn.; 13″x26″, Blatz & Kubs, Louisville, Ky.; 10″x20″, Roy Copper Co., Riverside, Arizona; 14″x24″, J. W. Dodge & Co., Beverly, Mass.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING FEBRUARY 19, 1884.

293,626 Electric bell-pull; Augustus S. Bunker, Lawrence, Mass.

293,632 Machine for laying electric-conducting wires; Henry B. Cobb, Wilmington, Del.

293,688 Underground electric-wire conduit; Chas. H. Trask, Lynn, Mass.

293,735 Marine electric messenger; John C. Henderson, New York, N. Y.

293,736 Time signal for toll lines of telephone exchanges; Angus S. Hibbard, Milwaukee, Wis., assignor to the Western Electric Company, Chicago, Ill.

293,758 Dynamo-electric machine; Adolph E. Gustav Lubke, New York, N. Y.

293,775 Telegraph cable; William R. Patterson, Chicago, Ill., assignor to the Western Electric Company, same place.

293,828 Thermostatic-electric registering apparatus; Charles W. Weiss, Brooklyn, assignor of one-half to Charles Kruse, New York, N. Y.

293,851 Electric safety device for elevators; Jacob William de Castro, New York, N. Y.

293,879 Manufacture of incandescing electric lamps; William Holzer, Harrison, N. J.

293,921 Cut-out for electric arc lamps; Henry C. Townsend and Charles L. Buckingham, New York, N. Y.

293,922 Printing telegraph; Henry Van Hoevenbergh, Elizabeth, N. J.

293,923 Electro-mechanical movement; Henry Van Hoevenbergh, Elizabeth, N. J.

293,924 Electro-mechanical movement; Henry Van Hoevenbergh, Elizabeth, N. J.

293,925 Electro-mechanical escapement; Henry Van Hoevenbergh, Elizabeth, N. J.

293,926 Printing telegraph; Henry Van Hoevenbergh, Elizabeth, N. J.

293,943 Cut-out for electric lamps; Charles L. Buckingham and Henry C. Townsend, New York, N. Y.

293,944 Electric arc lamp; Charles L. Buckingham and Henry C. Townsend, New York, N. Y.

293,956 Quadruplex telegraph; Bette E. J. Ells, Washington, D. C.

293,959 Unison mechanism for printing telegraphs; Stephen D. Field, New York, N. Y

293,974 Multiple circuit controller; William Fitz Charles Mason McCarty, Moscow, Russia, assignor to James F. Pierce, trustee, New York, N Y.

293,979 Telegraph key; Charles Plumb, Buffalo, N. Y., assignor of one-half to O. P. Babcock, same place.

293,980 Electric gong; Jerome Redding, Malden, Mass.

293,995 Electro-magnetic car-brake; James E. Withers, Henderson, Ky., assignor to Robert A. Holloway, same place.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

The demand for electrical apparatus and supplies is daily increasing with remarkable rapidity, and in no locality do we find this more noticeable than in the South, especially in the cities of Washington and Baltimore. Recognizing the necessity of keeping abreast of this progress in the electrical field, we notice that the young and well-known electricians and experts, Messrs. Royce & Marean, of Washington, D. C., have largely increased their capacity for furnishing electrical supplies and apparatus of all kinds, and are evidently reaching out and securing the Southern trade largely. These gentlemen are already too favorably known in this field to need any indorsement as electricians.

The Merchants' Electric Light and Power Company, of Danville, Ill., have ordered an "Ide engine" of 60-horse power for their plant of Jenny lights.

BUSINESS NOTICES.

A. C. NORTHROP, Waterbury, Conn. Iron and Brass Machine Screws, Zinc in Sheets and Plate for Electrical Purposes, Parts for Telephone and Telegraph Instruments, Manufactured from Iron, Brass, Steel or Zinc.

A. G. DAY, Kerite Insulated Telegraph and Telephone Wire and Cables, Anti-induction Kerite Telephone Cables, CLARKE B. HOTCHKISS, New York. Send for circular and prices.

ALFRED F. MOORE, Philadelphia, Pa. Telegraph, Telephone, Electric Light, Office, Line and Annunciator Wire.

AMERICAN BELL TELEPHONE CO., Boston, Mass. Electric Speaking Telephones for Exchange Systems, Private Lines, and Speaking-tube Lines.

AMERICAN ELECTRICAL WORKS, Providence, R. I. Patent Finished Insulated Electric Wires, Telephone and Electric Cordage. Electric Light Wire, Magnet Wire, Patent Rubber covered Wire, Aerial and Underground Cables, &c., &c. Send for prices.

AMERICAN SPIRAL TELEPHONE WIRE CO., Boston, Mass. Spiral Telephone Wire for long and short distance Telephoning. Write for information.

ARMINGTON & SIMS, Providence, R. I. Engines for Electric Lighting and general use.

AUSTIN GALLAGHER, New York, Keith Electric Light System complete for Arc Lighting. Stock for sale.

BAXTER ELECTRIC LIGHT COMPANY, New York. The Baxter Lamp.

B. W. PAYNE & SONS, Corning, N. Y. The Payne Single and Double Valve Automatic Engine. Send for catalogue.

BERGMAN & CO., New York. The Bergman and Haid Battery for Telephone and Telegraph purposes. Send for circular.

BOULTON CARBON CO., Cleveland, Ohio. Carbons for Electric Light purposes. Send for quotations.

BROWNLEE & CO., Detroit, Mich. Telegraph and Telephone Poles.

BRUSH ELECTRIC CO., Cleveland, Ohio. Arc Lights and Brush Storage Batteries.

BUFFALO ELECTRIC WORKS, Buffalo, N. Y. Carbon Points and Plates.

BUTLER SAFES, New York. Fire and Burglar-Proof.

CHARLES WILLIAMS, JR., Boston, Mass. Call Bells, Electric Bells, District Bells, Switch Boards, Annunciators, &c., &c. Write for quotations.

CHICAGO INSULATING CO., Chicago, Ill. The Fiske-Mott High-resistance Insulator. Send for circular.

CHROME STEEL WORKS, Brooklyn, N. Y. Steel for Magnets a specialty; Chrome Cast Steel.

COE BRASS CO., Torrington, Conn. Brass, Copper and German Silver in every variety of Sheets, Rolls, Plates, Wire, Rods and Blanks or Shells. Pure Lake Superior Copper Wire and Battery Zincs. Write for price list.

C. V. STAFFORD & CO., Acton, Ont., Canada. Telegraph and Telephone Poles.

D. VAN NOSTRAND, New York. Scientific Books. Send for circular.

ELECTRICAL DEVELOPMENT COMPANY, Boston, Mass.

ELECTRIC GAS LIGHTING CO., Boston, Mass. Improved Electric Gas Lighting Apparatus.

ELECTRIC STORAGE AND LIGHT CO., Boston, Mass. Own patents for Faure's Storage Batteries for territory of Rhode Island, Connecticut and Massachusetts.

H. M. RAYNOR, New York. Platinum for all purposes.

HOLMES, BOOTH & HAYDENS, New York. Fireproof Electric Light Wire, Patent "KK" Insulated Copper and Iron Wire for Telephone and Telegraph use. Send for catalogue and prices.

I. W. COLBURN & CO., Fitchburg, Mass. Dynamo Electric Machines.

IVISON, BLAKEMAN & TAYLOR, New York. Ink of all kinds and colors. Circulars sent on application.

JARVIS ENGINEERING COMPANY, Boston, Mass. Boilers set with the Jarvis Patent Furnace.

JOHN H. MUEGGE, New York. Platinum, Chemical Apparatus, Crucibles, etc.

LECLANCHE BATTERY COMPANY, New York. The Great Telephone Battery. Write for description and prices.

J. H. BUNNELL & CO., New York. The Morse Learner's Instrument, Telegraph Instruments of all kinds, Telephone and Telegraph Supplies. Illustrated Works on Electrical Measurement, and the Galvanometer and its uses. Send for catalogue.

LAW TELEGRAPH CO., New York. The Law Battery for Telephone and Telegraph purposes.

LOCKWOOD & FOSTER, New York. Learners' Telegraph Instrument.

MUTUAL DISTRICT MESSENGER CO., Boston, Mass. Addressing and Distributing Circulars &c., &c. D. J. Hern, General Manager.

NEW ENGLAND BUTT COMPANY, Providence, R. I. Braiding Machinery for covering Telegraph, Telephone and Electric Light Wire, Single and Double Winders and Braiders of every description; also Fine Castings. Send for catalogue.

O. W. MADDAUS, New York. Designer and Engraver.

PAINE & LADD, Washington, D. C. Attorneys in Patent Causes, and Solicitors of Patents.

PALMER WIRE CO., Palmer, Mass., and New York. Galvanized Telephone and Telegraph Wire Iron and Steel Wire of best quality, Material, finish and conductivity. Write for quotations.

PARTRICK & CARTER, Philadelphia, Pa. Electric Annunciators, Learners' Instruments, Batteries and Telegraph and Telephone Supplies. Write for circulars.

PHOSPHOR BRONZE SMELTING CO., Philadelphia, Pa. Telephone Wire, insulated and bare.

RHODE ISLAND TELEPHONE & ELECTRIC CO., Providence, R. I. Manufacturers of the Providence Telephone Switch Boards, Breckenridge Jacks, Wright Cable Clips, Howard Safety Appliances, &c.

SCHLEICHER, SCHUMM & CO., Philadelphia, Pa. Manufacturers of the Otto Gas Engine. Write for catalogue.

STANDARD ELECTRICAL WORKS, Cincinnati, Ohio. Manufacturers of Telegraph and Telephone Instruments, Magneto Bells, Switch Boards and Telephone Exchange Apparatus, Annunciators, Wire, Batteries, Insulators, Electric Light Wire and Supplies. Send for circular and prices.

SWAN INCANDESCENT ELECTRIC LIGHT CO., New York. Incandescent Lights, and Complete Apparatus. Send for illustrated catalogue.

THE ANSONIA BRASS AND COPPER CO., New York. Pure Electric Copper Wire for Magnets, Telephone Lines, and Electric Light purposes, Office Wire, Zinc Rods and Battery Copper.

THE BISHOP GUTTA PERCHA WORKS, New York, Gutta Percha Insulated Submarine Telegraph Cables Subterranean Telegraph Cables, Aerial Telegraph Cables, Lead or Hempen covered Torpedo Cables, Lead-covered Cables, Telephone Cables of all kinds—G. P. Office Wire, and Marks' Compound Insulated Wire, &c., &c. Send for catalogue.

T. H. ALEXANDER, Washington, D. C., Solicitor and Counselor in Patent cases.

THOMPSON-HOUSTON ELECTRIC LIGHT CO., Boston, Mass. Automatic Self-regulating System of Arc Lighting.

THE ELECTRICAL SUPPLY CO., New York. Electric Light, Telephone and Telegraph Supplies. Send for price list and catalogue.

TRENTON IRON CO., Trenton, New Jersey. Galvanized Iron and Steel Wire of all kinds for Telephone and Telegraph purposes. Write for prices.

TROPICAL AMERICAN TELEPHONE COMPANY, Boston, Mass. Telephones and Telephonic apparatus, for Mexico, Central America, West India, and South America.

UNITED STATES ELECTRIC LIGHT CO., New York. Arc and Incandescent Lights, complete and reliable systems, &c. Write for information.

UNION ELECTRIC MANUFACTURING CO., New York. Manufacturers of all kinds of Telegraph, Telephone and Electric Light Apparatus. Send specifications.

VIADUCT MANUFACTURING COMPANY, Baltimore, Md. Electrical Goods of every description. Electric Light and American District supplies. Send for price-list.

VICTOR, BISHOP & CO., New York. Platinum for all Manufacturing, Chemical and Electrical purposes. Send for prices.

WESTERN ELECTRIC CO., New York, Boston, and Chicago. Telegraph and Telephone Apparatus and Supplies of every description. Send for catalogue.

WM. A. HARRIS, Providence, R. I. The Harris-Corliss Steam Engines and Light and Heavy Castings.

WATTS, CAMPBELL & CO., Newark N. J. Improved Corliss Steam Engines. Send for catalogue.

W. R. POPE & CO., Baltimore, Md. Telegraph, Telephone, and Electric Light supplies. The best of everything, and at lowest prices.

NATIONAL ELECTRIC COMPANY. Washington, D. C. Electrical supplies and apparatus.

ROYCE & MAREAN, Washington, D. C. Dealers in Electrical apparatus, Telegraph and Telephone supplies.

Average Market Quotations of Battery Supplies for the Week Ending February 28, 1884.

Disque Leclanche Battery, per cell	$1.00
" " Porous Cups	25c.
" " Jars	25c.
Prism Leclanche Battery, per cell	$1.95c.
" " Prisms, per pair	30c.
" " Carbons	20c.
" " Jars	5c.
" " Jar cover	2c.
Chlorine Battery, per cell	$1·25.
Leclanche zincs	12c.
Law Battery, per cell	$1.25
" Jar and its Rubber Ring	25c.
" Cover, with small Carbon sealed in	35c.
" Large Carbons, each	20c.
" Carbon Connector	12c.
" Zinc Connector	8c.
" Rubber Bolt	12c.
" Zinc and its Rubber Ring	12c.
Bergman & Haid, per cell	$1.20
Crow foot, 6x8, per cell	75c
Callaud Zincs	30c.
" Coppers	18c
" Jars	25c
Sal Ammoniac, per lb	12½c.
Blue vitriol, per lb	6½c
" " bbl., lots, per lb	5½c.
Sulphate of zinc	10c.
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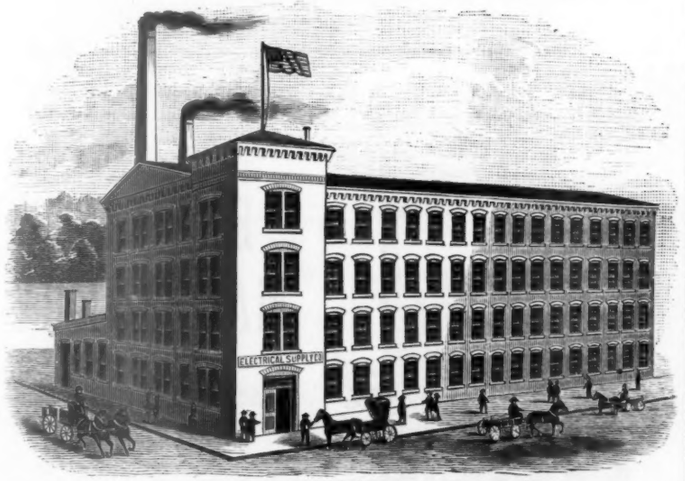

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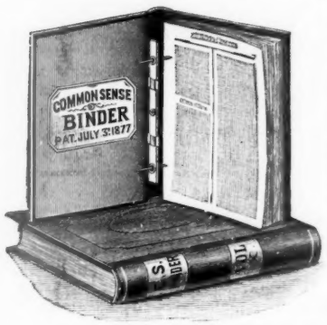

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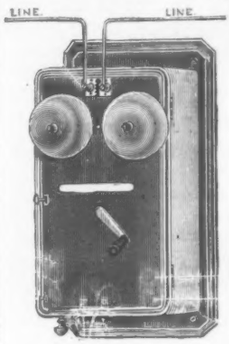

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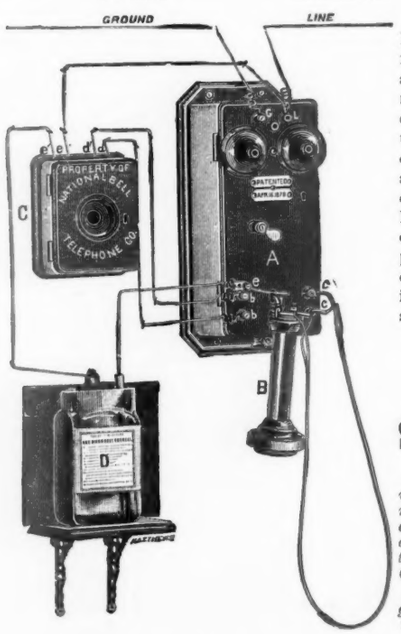

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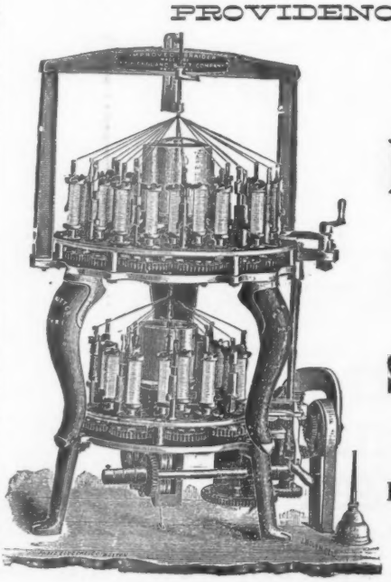

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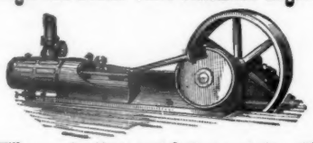

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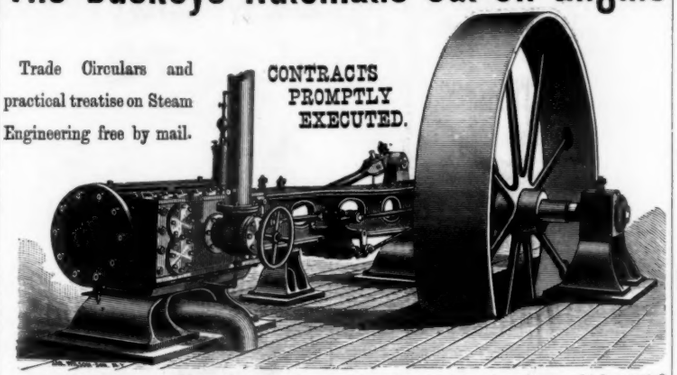

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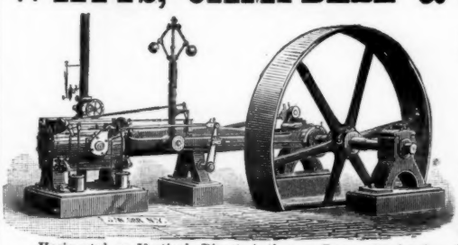

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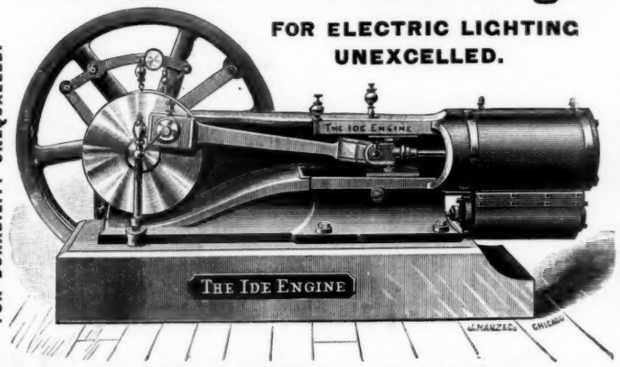

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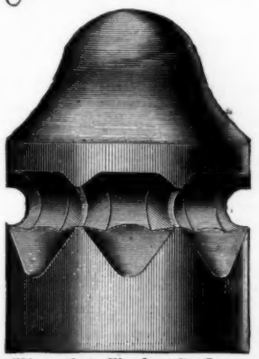

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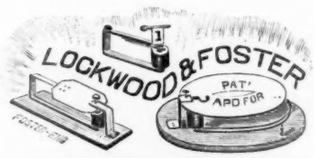

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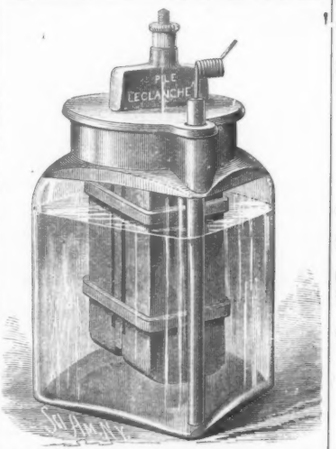

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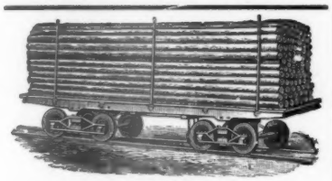

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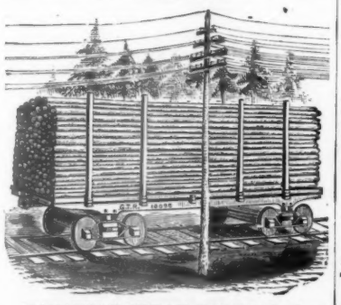

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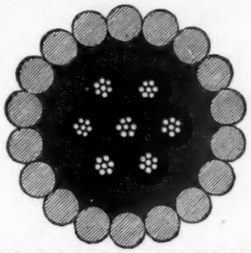

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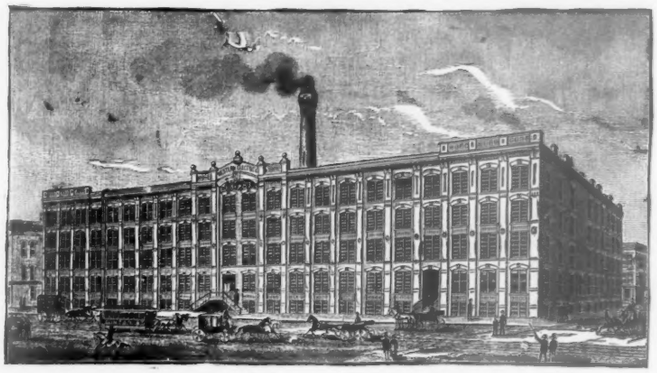

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